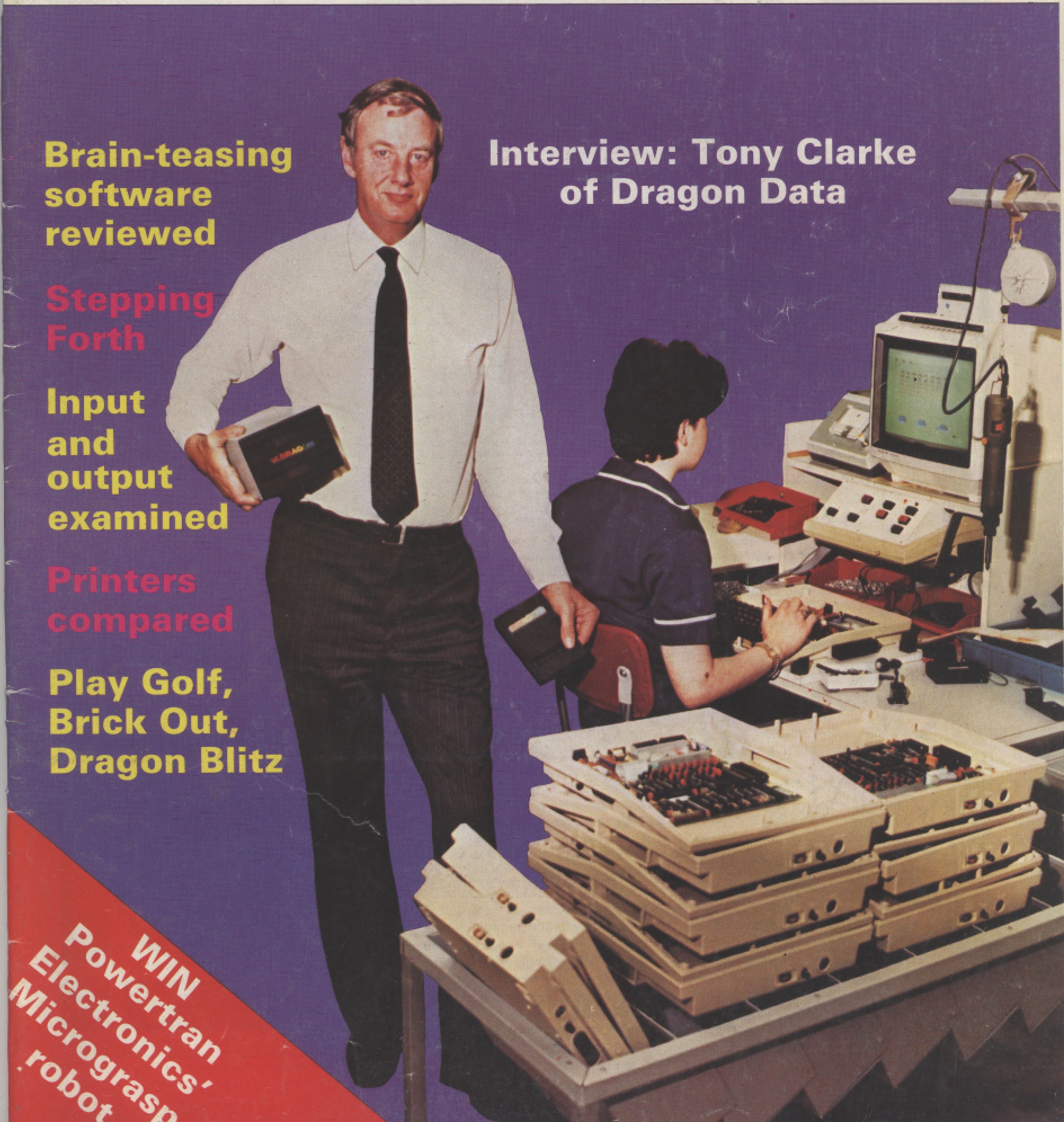
DRAGON USER

The independent Dragon magazine

International edition

60p US$2.60 July 1983



Interview: Tony Clarke of Dragon Data

Brain-teasing software reviewed

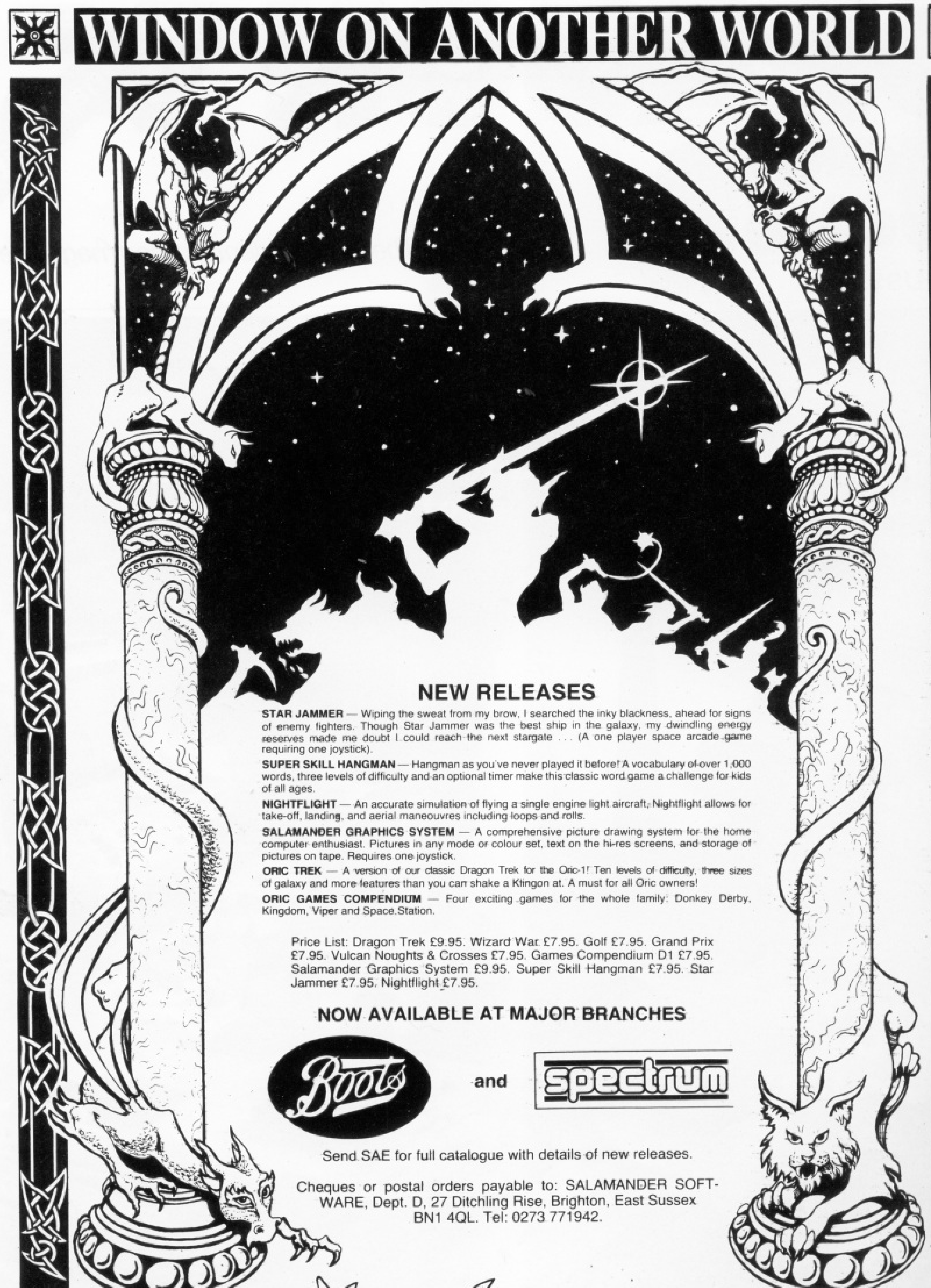
Stepping Forth

Input and output examined

Printers compared

Play Golf, Brick Out, Dragon Blitz

WIN Powertran Electronics' Micrograsp robot


WINDOW ON ANOTHER WORLD
NEW RELEASES
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DRAGON USER

July 1983

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How to submit articles

The quality of the material we can publish in *Dragon User* each month will, to a very great extent, depend on the quality of the discoveries that you can make with your Dragon. The Dragon 32 computer was launched on to the market with a powerful version of Basic, but with very poor documentation.

Every one of us who uses a Dragon will be able to discover new tricks and quirks almost every day. To help other Dragon users keep up with the speed of the development each of us must assume that we made the discovery first — that means writing it down and passing it on to others.

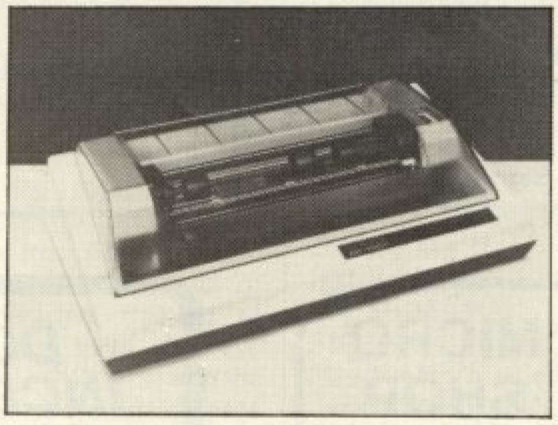
Articles which are submitted to *Dragon User* for publication should not be more than 3000 words long. All submissions should by typed. Please leave wide margins and a double space between each line. Programs should, whenever possible, be computer printed on plain white paper and be accompanied by a tape of the program.

We cannot guarantee to return every submitted article or program, so please keep a copy. If you want to have your program returned you must include a stamped, addressed envelope.

We pay for articles according to the length and the quality — it is worth making that extra bit of effort.

Contents

SUNSHINE



Editorial

DRAGON DATA'S PLANS TO move upmarket this year, launching two bigger machines, will bring it into an even stronger position to attack the educational market. This is one area in which the Conservatives are particularly proud of their achievements, through the micros-in-schools scheme. But how justified is their pride? And, more importantly for Dragon Data, how free and open to attack is this market?

In fact, the Conservative record is less bright than they are willing to acknowledge, and their achievements are tarnished rather than burnished. Many school children are still never getting near a computer, or are finding that their interests are not being matched by the Conservative policies. So far most secondary schools have no more than one micro, and half the UK's primary schools are still left without a machine. The scheme's declared aim is to provide schoolchildren with the instruction and hardware to prepare them for the future. Obviously the Conservatives have a low expectation of schoolchildren's survival — and high hopes of a fall in the birthrate.

The shortage of machines is compounded by divided government responsibilities. The micros-in-schools scheme is sponsored by the Department of Industry but the actual use of the machines is more the responsibility of the Department of Education and Science. The junior Education Minister acknowledged this spring that it was no good having the computers without the right software and admitted that a great deal more was still needed. He also admitted that not all local education authorities had been able to benefit in equal measure. The Industry Department's response was to add small-scale robots to the list of hardware that it is willing to subsidise.

The micros-in-schools scheme is also put forward as a prime example of what the Conservatives call enlightened public purchasing, or what others call buying British. Doubtless Clive Sinclair has some unprintable opinions about how enlightened the scheme was when it excluded his machines. And Dragon Data, by most counts the third most successful British home computer manufacturer, is still excluded. For a party which professes to believe in the virtues of the free market, the Conservatives are remarkably keen to indulge in high publicity persuasion from above, while ignoring surges in popular interest from below.

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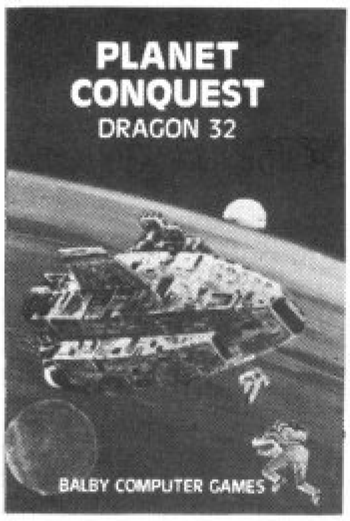
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Letters

This is the chance to air your views — send your tips, compliments and complaints to Letters Page, *Dragon User*, Hobhouse Court, 19 Whitcomb Street, London WC2 7HF

Hex blunders

I WOULD like to congratulate you on the May issue of *Dragon User*. My only complaint is the poor standard of the program listings, particularly Hex. Whilst this was only a slight annoyance for me, I would imagine it could cause some headaches for an inexperienced programmer.

The major faults in that program were as follows:

Line 410 should read STEP-1
Line 430 should read FORI = 0 TO N
Lines 540, 900, 950, 1060 and 1110 should read PAINT
Line 550 should read PSET (14,1,5)
Line 980 should read PSET (196,169+1,8)

May I also give a small tip to Mr Owen (or any other of your readers who dislike typing): the end of line 210 (after the colon) and the whole of line 340 are unnecessary, also lines 1200 to 1300 may be replaced by:

```
1200 IF A$<"A" OR A$>"K"
     THEN 1200
1210 A = ASC(A$)-64
```

A lot of the repetitive typing of co-ordinates may be saved by the inclusion of a few FOR . . . NEXT loops.

P F Grubb,
Oldham.

Useful advice

MAY I reply to two of the letters in your May issue and pass on some more useful advice? S J Beal is correct in thinking that the Dragon has a delay built in to the cassette operating system. This is part of the PRINT#-1 command.

When a PRINT#-1 command is found, the computer stores this information in the cassette buffer and then continues with the next Basic statement. When the cassette buffer has been completely filled the cassette recorder is turned on and, after a short delay, the data is written to tape. The program then continues with the next Basic statement. If the cassette buffer is partially filled with data it is flushed on reaching a CLOSE#-1 statement.

If some difficulty is experienced in recording and recovering data it is possible to increase the delay time between the MOTOR-ON and the SAVE routine. The two locations which control the delay time are 149 and 150. Therefore if you POKE these locations with 255 it will delay the saving procedure.

Anthony Edwards explains how to reduce the amount of memory reserved for graphics page 1. What he omits to mention is that the default value for PCLEAR is 4, ie, on power-up the Dragon automatically reserves 6K of RAM for 4 graphics pages whether you need them or not.

Check this by switching off the m/c, switching on again and ?MEM. This will show you that there are only 24,871 bytes free for Basic. If you PCLEAR1 and then ?MEM again you will see that you now have 29,479 bytes free, an immediate gain of 4.5K. This is useful to remember for those large text programs not requiring any hi-res graphics.

I must say that I liked the Character Generator program, seeing lots of potential in this. By using David Lawrence's tip on memory saving I reduced the size of array necessary to store an 8x8 pixel square from A(8,8) to A(2). This allowed me to construct 26 graphic characters (instead of five) and store them in arrays A(2) to Z(2). I PUT these into the third quarter of the screen (page 3) so that I could save them onto tape with CSAVEM"name", 4608, 6144, 1536. I could then load those back from tape with CLOADM"name", GET them from their locations on page 3, and store them back into the arrays A(2) to Z(2) for use in my graphics programs. An extremely useful facility, available on other micros, but not originally available on the Dragon.

Just one tip to others wishing to use these ideas. Occasionally the program will crash with an OM error message. Ignore this and re-enter the program with GOTO9030, the program will be reinstated, complete with graphic characters and you can carry on where you left off. The reason for this is that the complicated mixture of GOTOs, GOSUBs, RETURNs and jumping out of nested loops results in the build up of stack pointers.

If you have the patience to sort out the logic you can simplify the procedure so that this does not happen. Remember every GOSUB should terminate with a RETURN. Good luck!

Colin Mackie,
Harlech,
Gwynedd.

Keys for Pacman

IN THE May issue of *Dragon User* Pacman is a very good game, but the 'I', 'M', 'J' and 'K' keys are hard to use. So I use the cursor keys. To do this change lines 280, 290, 300 and 310 to read:

```
280 If Q$ = CHR$(94) THEN
    M=M-32
290 If Q$ = CHR$(10) THEN
    M=M+32
300 If Q$ = CHR$(8) THEN
    M=M-1
310 If Q$ = CHR$(9) THEN
    M=M+1
```

Even now it is still hard to keep on pressing the keys for each move of Pacman. So add these lines:

```
271 If Q$ 43= CHR$(94) OR Q$
    = CHR$(10) OR Q$ =
    CHR$(9) OR Q$ = CHR$(8)
    THEN 273
272 Q$ = C$
273 C$ = Q$
```

Now just push the arrow that you want and Pacman will move until you turn it in a different direction or it comes across a wall.

Richard Holt,
Walsall,
Staffs.

Software Top 10

1	(1)	**The King**	Microdeal
2	(4)	**Space War**	Microdeal
3	(—)	**Defence**	Microdeal
4	(6)	**Alcatraz II**	Microdeal
5	(2)	**Katerpillar Attack**	Microdeal
6	(—)	**Space Monopoly**	Microdeal
7	(—)	**Mansion Adventure**	Microdeal
8	(9)	**Chess**	Dragon Data
9	(—)	**Typing Tutor**	Dragon Data
10	(5)	**Dragon Trek**	Salamander

Chart compiled by Boots

Storing data sets

WITH REFERENCE to David Lawrence's article on file procedures in your May issue, I would suggest that listings 2 and 3 should be modified as follows:

a) Lines 1050 and 1100 be modified:

```
1050 OPEN "O", £-1, ZZ$
1100 OPEN "I", £-1, ZY$
```

b) Two additional lines should be inserted:

```
1045 INPUT "INPUT FILE
NAME"; ZZ$
1099 INPUT "INPUT FILE
NAME"; ZY$
```

c) as a result of b), Line 1020 requires modification at its end to read

```
1020 ———— " ———— : ON Q GO
TO 1040, 1099
```

The result of this modification is that more than one set of data can be stored and loaded for the same program, each set being easily identified by its individual file name.

Seville R Holt,
Chorley.

The right commands

AFTER READING through the Missile Command program published in June I list below typing errors.

```
1 IF MM<50 OR INT
(MM)<>MM THEN 0
30 CLS : X=128 : Y=96 : TC=4 :
S=0 : N=0
160 PMODE3,1 : SCREEN 1,0 :
PCLS2 : COLOR3,2
220 DRAW "C4,BM118,191;
E10; F10"
```

Delete line 360

460-500 replace C=C-1 with TC=TC-1

```
570 FOR Z=1 TO M
610 IF Y>=MY(Z)-A AND
Y<=MY(Z)+A THEN SOUND
100,1 : MX(Z)=RND(255) :
MY(Z)=0 : N=N+1 : S=S+1
620 IF N<MM THEN 590
```

Also in the section for movement with keys

```
270 M$=INKEY$ : IF M$=" "
THEN M$=N$
```

The POKE in line 20 (20 POKE &HFFD7,0) will cause some computers to crash and it will be necessary to POKE &HFFD6,0 (or press reset) to CSAVE or CLOAD programs.

Andrew Black,
Hereford.


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Software range increases

SMALL SOFTWARE companies continue to make the most of the Dragon's success.

Devon-based MST Consultants is now offering a range of disk-based business software — running, so far, on Premier Microsystems' drives.

At the other end of the UK — on the Isle of Harris, off the west coast of Scotland — Bamby Software is adding more games to its range. Next in line is Scanner 13 which combines the elements of both arcade and adventure games.

And a new company, Silly Software, is offering advertising spots on its software. Its first release is Film Producer which "encompasses all the trials and tribulations of attempting to make a film".

Microcare offers to double memory

AN EXTRA 32K of memory for about £25 is the promise Microcare is making to Dragon 32 owners.

The company is offering an internal modification which will upgrade users' memory at a cost of about £25, including a figForth implementation.

The modification will only work on some machines — Microcare says most. The company needs to know your Dragon's serial number to check suitability.

At a later stage other users will be offered a different modification.

One snag is that the guarantee will be voided by the modification.

The service is available by post and Microcare expects to turn round machines in a week. The company can be contacted on (09363) 5695.

Wait continues for OS9 system

DRAGON OWNERS waiting to get to grips with the OS9 operating system will have to pay more than expected and wait until the end of summer.

The first drives available from Dragon Data run its own disk operating system — OS9 will not be available until September when the Dragon 64 is on sale.

Dragon Data had intended to offer a board swap for 32 owners giving them 64K of RAM. These upgraded machines would then have run OS9.

Now the company intends to offer a CPU swap in September giving users 64K of RAM and two ROMs. At the same time service agents will change the bottom half of the Dragon's moulding, adding an RS232 interface.

In effect, this results in a Dragon 64 which can run OS9 on the drives already available.

Pricing on this upgrade has not yet been decided, but it is likely to cost over £100. The Dragon 64 is expected to cost less than £275.

Tony Clarke, the company's managing director, said that software compatibility was behind the "second thoughts". He explained: "This will mean that both our own software and other people's can be run on both machines."

In fact, the US will be getting the Dragon 64 first. It will be sold there from August in a joint venture with Tano Corporation of New Orleans.

"The first few thousand American machines will be made here, the rest in the US," Tony said.

He added that the price of the Dragon 32 was unlikely to fall again following the recent price cuts. "We got the cost of producing the machine down so we passed it on to customers," he explained.

Micro robots link with Dragons

MICRO ROBOTS are arriving for the Dragon 32, beginning with arms from Powertran Electronics and Colne Robotics, followed by floor-crawlers from Colne and Jessop Electronics.

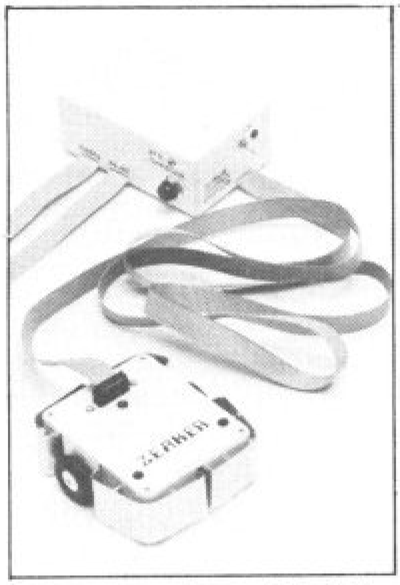
Powertran's Micrograsp has five axes and costs £199 (all prices exclude VAT). It is available now and comes with all the necessary interfaces.

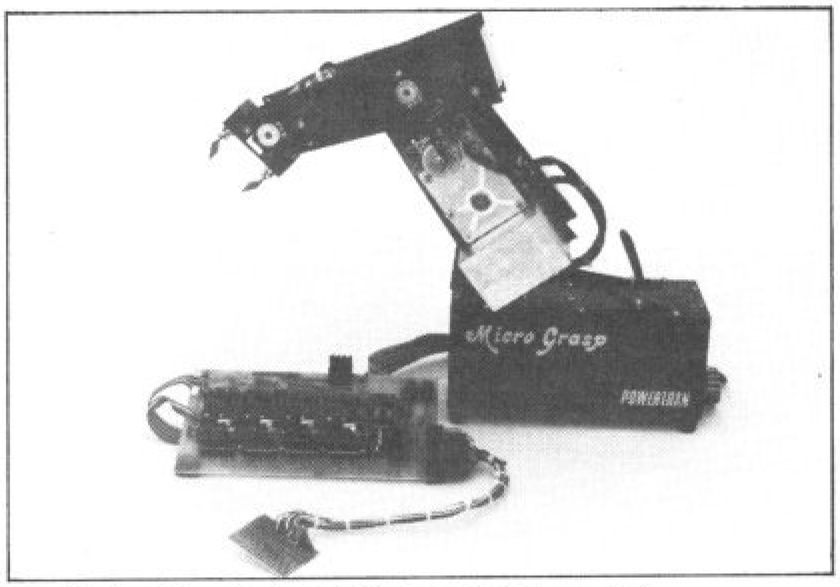
The Micrograsp has an articulated arm jointed at shoulder, elbow and wrist positions. The arm rotates about the base and has a motor-driven gripper and position sensors.

Also available now is Colne's Armdroid robotic arm which has six axes and costs about £400.

Both Colne and Dragon Data have backing from Prutech, the high technology investment division of Prudential Insurance.

Colne's Zeaker Micro-Turtle will be available for the Dragon from the beginning of July. This floor-crawling robot





Robots for the Dragon 32 – Colne Robotics' Zeaker Micro-Turtle and Powertran Electronics' Micrograsp

— at £50 in kit form, £70 built — has sensors, horns and the ability to execute Logo.

A third company will enter the market later this year when Jessop will be offering a Dragon-compatible version of its Edinburgh Turtle. The present price of this floor-crawler is £350.

John Jessop explained that the higher cost of the Edinburgh Turtle reflected its greater accuracy and ability to handle more complex drawings.

Economatics, which manufactures perhaps the most well-known home robot, the BBC Buggy, also has plans to add Dragon compatibility — but not until next year.

First it intends to look at the other machines in the micros-in-schools schemes, from Sinclair and Research Machines, before moving on to the Dragon.

Powertran Electronics can be reached on (0264) 64455, Colne Robotics on 01-892 8197, and Jessop Electronics on 01-739 3232.

News Desk

01-839 2449

Utility packages coming soon

MORE UTILITIES packages are on their way for the Dragon 32, including a full screen editor from Compusense and an EPROM programmer from Windrush Micro Systems.

Compusense will be adding the screen editor to its Hi-Res package in July, and plans to offer a word processing editor in September.

Users who have bought the Hi-Res package in the past six months can upgrade if they pay the difference in price and a small service fee.

Within the same period, Compusense is also offering free software upgrades to users of its packages.

For the moment the company has shelved its plans to market a disk drive system, being content with the demand for the cartridges it is offering.

By the end of the year, Windrush intends to add an EPROM programmer to its Mace package, a co-resident editor/assembler/monitor.

The company is not yet sure whether to go ahead with its PL9 system, an editor/compiler/debugger/monitor. The decision hinges on whether to include library routines.

Using cassettes or an OS9 disk system, this would involve a lot of swapping. However, the problem would be solved if the Flex operating system becomes available on the Dragon.

Sales push begins on schools

BIRMINGHAM firm Griffin and George has begun a marketing drive to sell Dragon 32s into educational establishments — and is looking for good software to sell with it.

Roger Blake explained that he expects demand for micros to increase in all areas of education — primary and secondary schools and in higher education.

A Department of Industry scheme to bring micros to schools only offers a discount on the first purchase of specified machines including the BBC B.

Schools buying more than one micro will have to look more carefully at prices. Roger commented: "The BBC B is a fine but expensive machine while the Dragon is good value."

Griffin and George is the largest firm in Europe in this market and already handles the Spectrum, so its experience is considerable.

The company will support the Dragon with whatever software meets its "high specification", and is looking for good packages to sell. Griffin and George is on (021) 236 2552.

Elkan answers memory questions

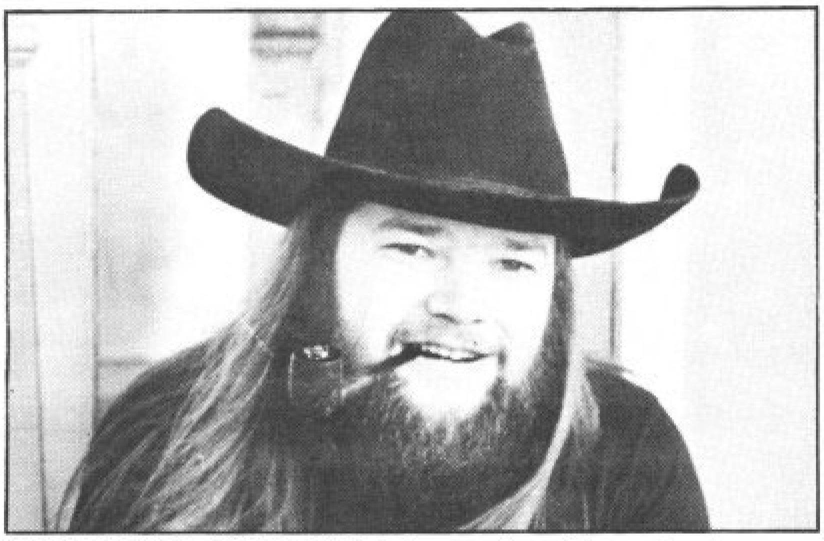
DRAGON 32 OWNERS wanting to know more about their machines' memory will find their questions answered in a reference booklet due out this summer from Elkan Electronics.

Called *The Dragon 32 user reference*, the booklet contains three pages mapping out the machine's memory.

For users who want to get more involved with machine code, the booklet also details system commands, string and numeric functions, inverse graphics, mathematical functions and keyboard addresses. The booklet has 18 pages and will cost £2.95.

News Desk

01-839 2449



SALAMANDER SOFTWARE is moving into adventure and role-playing games, beginning with Franklin's Tomb and following up with Castle Baron in the autumn. However, arcade players will not be forgotten: Laser Zone is set to follow Grid Runner and Everest on to the market. In Vic20 form Grid Runner had a long run in the software charts, and Laser Zone has an equally high reputation. The adventure games have no graphics on the screen but come with a 20-page manual including more than 20 illustrations. Salamander's Pete Neal explained that putting the graphics on paper leaves much more room in the memory for a complex adventure. The manual also contains clues, balanced by a sprinkling of red herrings. Castle Baron is a role-playing game which will have add-on modules allowing users to move from one module to another, developing the same character.

Self - centring joysticks

SELF-CENTRING joysticks will be available for the Dragon later this summer, or you can use them now if you buy an interface from Manchester firm Mr Micro.

Flight Link Control expects to have its semi-professional self-centring joysticks available in September. The mechanisms are ready now but casings need to be designed before volume production is begun.

The interface from Mr Micro, called Dragon Tamer, allows standard Atari or Atari-type joysticks to be used with the Dragon.

Both firms agree that the demand for professional and semi-professional joysticks is increasing.

But Flight Link Control's Idris Francis added: "It hurts to see American units inferior to our own selling at high prices here."

Flight Link Control does not usually sell direct to end users. It is the source for the joysticks from Microdeal, Midwich and Clares reviewed in last month's *Dragon User*.

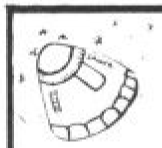
Idris said that half-a-dozen dealers were interested in selling upmarket joysticks. If these plans fell through, then Flight Link Control will consider selling direct to users itself.

The joysticks will cost about £20 each. Idris added that they will also be high in reliability and precision, stressing the sensitivity of the potentiometer mechanism they use.

But Jim Gregory of Mr Micro argued that most potentiometer joysticks have their sensitivity programmed out of them. He thinks that the digital switch system used in Atari-type joysticks is ideal for arcade-type games.

The Dragon Tamer costs £9.95 and comes with a games tape. Mr Micro also sells joysticks for use with the interface. These cost from £7.50 each.

Mr Micro is on (061) 728 2282, Flight Link Control on (0420) 87241.



Each month we write about one particular club — if you think yours should be featured here write to Clubs Page, *Dragon User*, Hobhouse Court, 19 Whitcomb Street, London WC2 7HF

Dragon clan gathering

The Scottish Dragon Club now has more than 500 members – we talk to the man in charge, David Anderson.

WORKING AS A croupier in an Edinburgh nightclub may seem a strange occupation for the president of the Scottish Dragon Club. But it gives David Anderson plenty of time during the day for running the club and exploring the Dragon — and plenty of experience to incorporate into the roulette and blackjack programs he is writing.



Club president David Anderson

David bought his Dragon last summer and started the club with a couple of friends in September. It began with half a dozen people meeting in his flat — "I had the most space," he explains. But the idea mushroomed: each person put in about £20 and a postal club was started. Now there are more than 500 members, "amazingly widespread", ranging from the outer Hebrides to Denmark and "increasing at an accelerating pace". However, David adds that "there is a kind of contradiction — most of the members are in England".

Most of the money was spent on items such as stationery, and a little on advertising. But the organisers decided "it was silly running the club like a business by advertising". Now they rely, successfully, on word-of-mouth with members getting their friends to join.

David reckons that most people who join are more interested in playing games than programming, preferring to develop their own "arcades-in-the-sitting-room". And the club can help them do this. It costs £8 to join and this lasts you forever. In return you receive a newsletter with tips, advice and, most importantly, news about the club's discount offers.

Various software companies sell their games to members at discounts which range from 10 per cent to 20 per cent. Some business packages are also on offer. Firms participating in the scheme include Shards, Wizard Software and DACC. David added that Microdeal is not included "but has always been very helpful to the club". American magazines are also available at a discount — through Elkan Electronics.

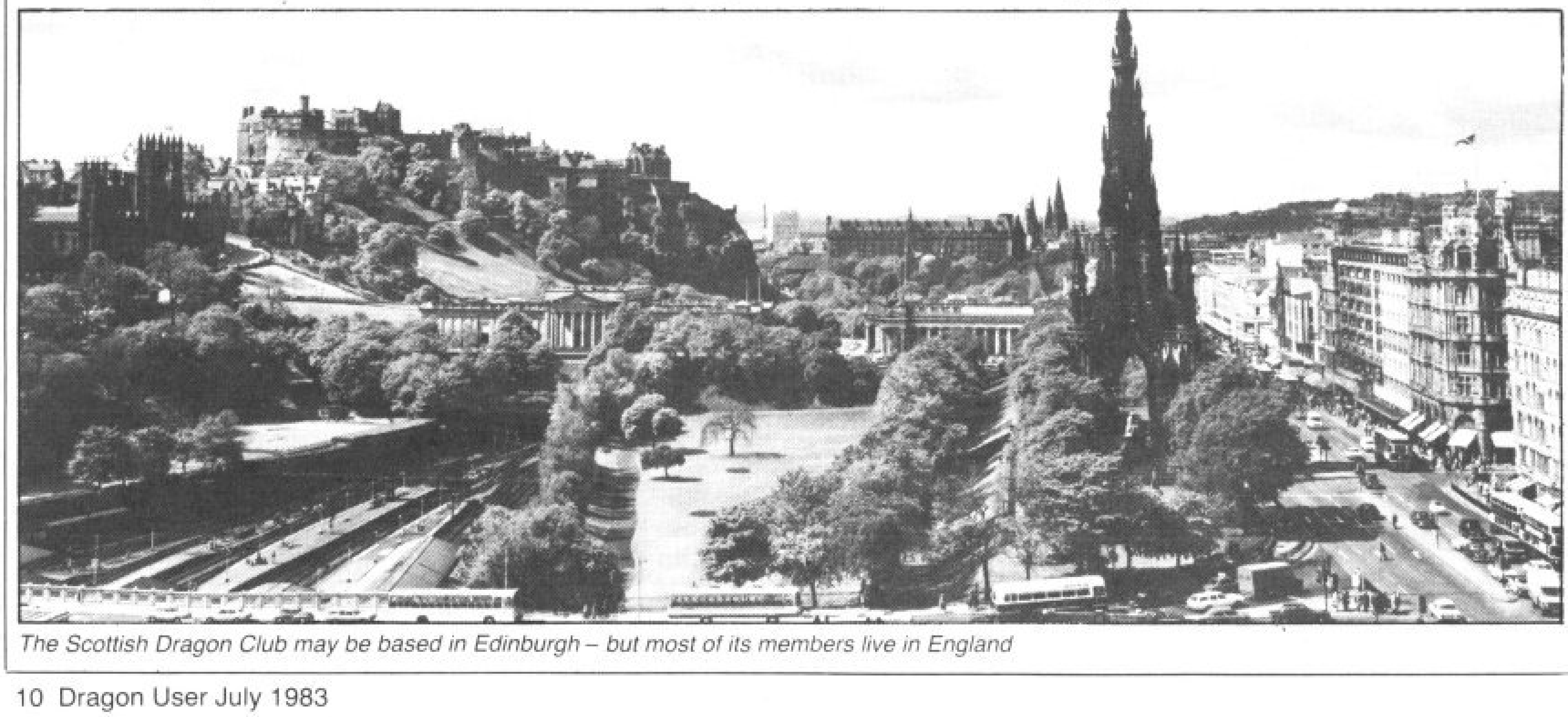
There are also plans to sell joysticks to members at less than £10 a pair, although David said that these have to be tested first. Other possibilities include cheap blank cassettes tapes from Hong Kong and a reduction on the Amber 2400 printer. A Dragon repair service at a discount is already on offer and is likely to become more popular as Dragons come to the end of their guarantee periods.

The aim now is to get the newsletter out monthly. New members get a starter pack with the latest newsletter and a list of firms offering discounts. But David explained that there is more to the club than lower prices: "The aim is to search for good software and hardware for the Dragon — because there is so much bad stuff." Everything offered is vetted first by David or one of his co-helpers. Eight people are now involved with running the club, helping with typing, photocopying and answering members' queries. But the club still takes up an "inordinate amount" of David's time.

He himself is a "dedicated games man" and is most impressed by the quality of software coming out now, particularly from Microdeal. He hopes to move into becoming a full-time games author (hence the casino programs mentioned earlier), or maybe even starting his own software company. But he stressed that the club would remain independent whatever his occupation.

David's interest in computers goes back to school, although he dropped the subject at university. The ZX81 revived his enthusiasm, but he got fed up because a "screenfull of program meant you were out of memory". And so he moved on to the Dragon 32 "and fell in love" — in particular with the Draw commands. However, he added that the BBC B was now tempting him to move up again.

Whatever his next machine, the club will continue — its nucleus of eight Dragon enthusiasts will see to that. The club can be reached at 1 Walker Street in Edinburgh.



The Scottish Dragon Club may be based in Edinburgh – but most of its members live in England

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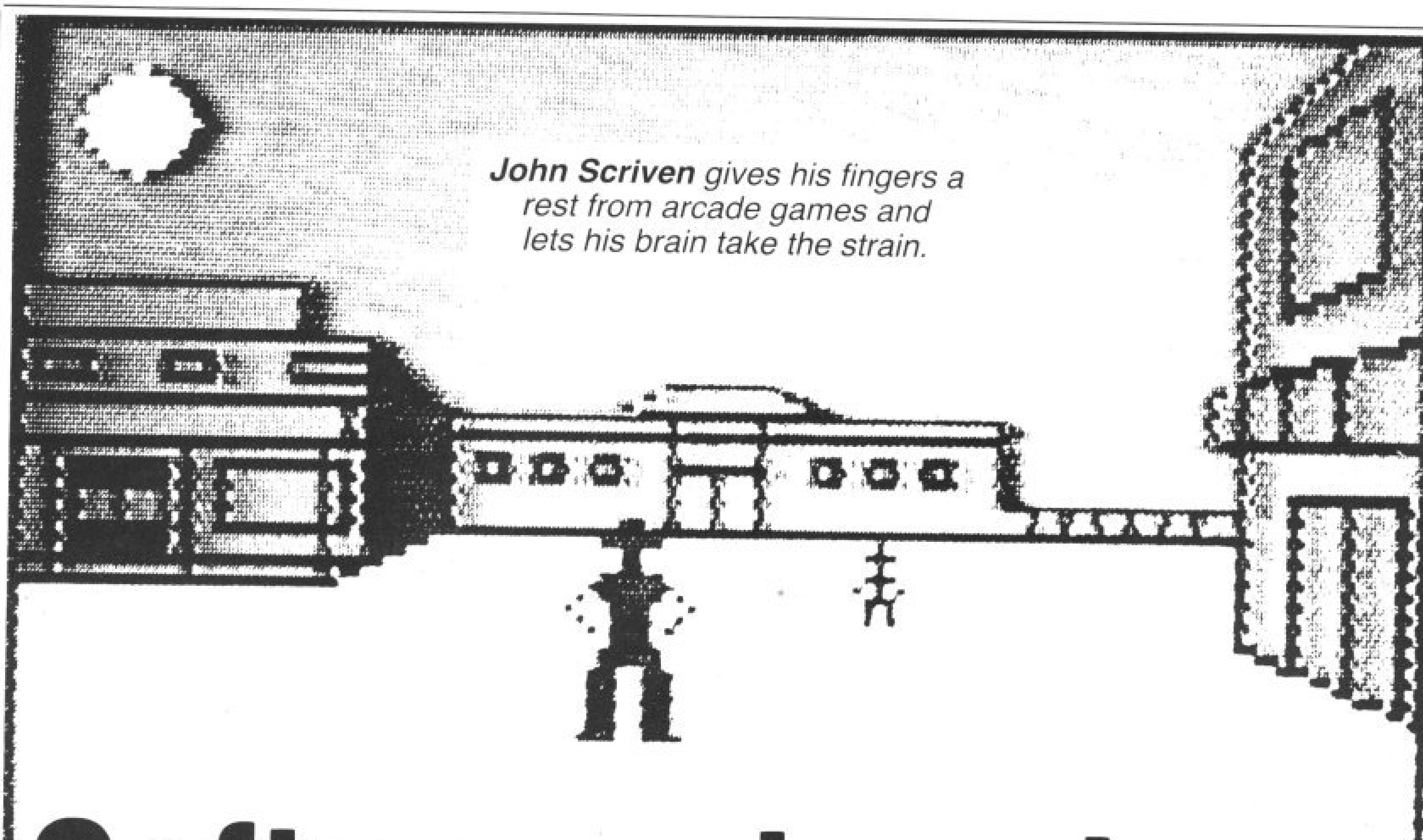
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John Scriven gives his fingers a rest from arcade games and lets his brain take the strain.

Software showdown

A & F Software's Deadwood – transports you to the Wild West where you can win ranches or saloons and trade in gold

AFTER LAST MONTH'S spell of zapping and high speed alien destroying, this month I shall concentrate on the sort of games that tend to make your brain, rather than your fingers ache.

In general, arcade-type games need to be written in machine code to approach the speed of the original, but most of those that rely on logical processes do not always need this speed and can be quite successfully written in Basic.

Escaping graphics

An exception to this are games that use high quality graphics, and a fine example of this genre is Escape from Microdeal. Similar to Sultan's Maze and Phantom Slayer (reviewed in last month's *Dragon User*), this involves escaping from a three-dimensional maze. At the start, you find yourself trapped on the top floor of a building. There are no hidden monsters waiting to pounce on you, all the inhabitants are friendly, and it is even comparatively easy finding your way to the lift (or elevator as this US game prefers it).

The problem lies in the fact that the elevator provides the only means of escape, and unless the correct code is entered, you will plummet to instant death. "The fall is fun, but the stop at the end is a real killer," as the sleeve notes succinctly put it! To obtain the magic combination, you may enter various rooms and attempt to decode mysterious sayings. This is a pleasant combination of several ideas and is an interesting program to add to any collection. It is not so easy to acquire the correct code and I now know the inside of the lift shaft most intimately!

Since the recent court case, it appears that there is no longer any monopoly on the name Monopoly! A program that uses the format of this popular board game is Deadwood from A & F Software. Instead of the salubrious settings of London and Manhattan, you are transported to Wild West frontierland, and you can acquire ranches or saloons rather than Mayfair or the Old Kent Road. If you feel Lady Luck is on your side, you can gamble away your earnings or trade in gold.

The display shows an exceptionally fine introductory picture, but the game is conducted in a lower resolution, the positions of the players being shown by different colours. The explanations are very clear but the screens flash by rather rapidly. One distinct advantage is that you can set the total length of the game at the start. This is an original variation of an old favourite at £6.90.

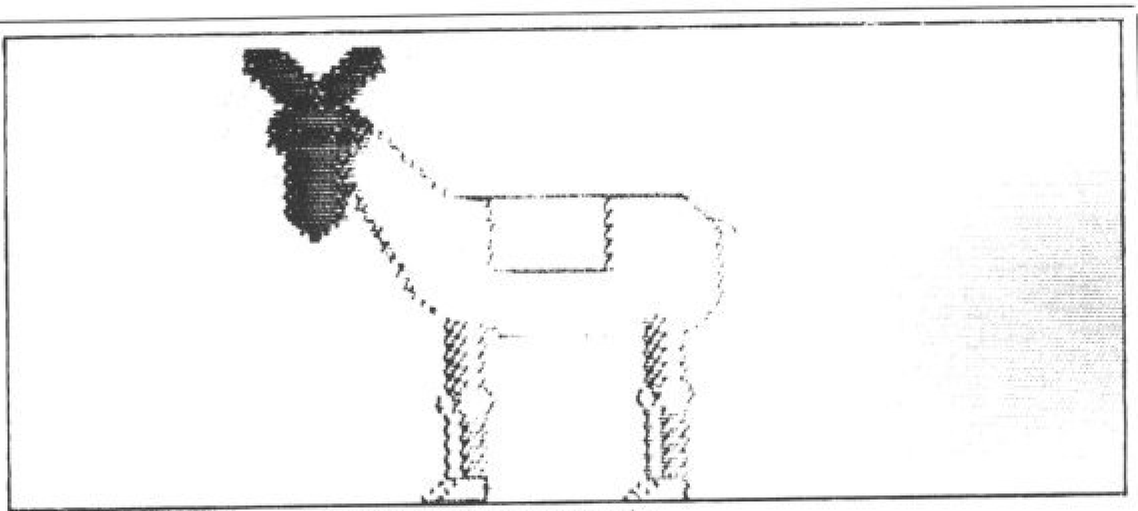
Those of you who are Startrek fans will probably be pleased to know that there are several versions of this game available for Dragon owners. Before I come to these, you may be interested in a game inspired by the TV programme. You probably remember the fiendish games of 3-D chess played by Spock and company. Salamander Software has produced a slightly easier version for us mere earthlings, entitled Vulcan Noughts and Crosses. The positions for play are chosen by entering X, Y and Z co-ordinates on a four by four by four board. (It's a shame that the origin is at the top left rather than the mathematical convention of bottom left.)

Long before the age of the micro-chip, there used to be a board game very popular with children that used the same principle on a four layer perspex board, and it was easy to align your sight along completed rows. On the computer version it is often difficult to see these rows until it is too late, as the four layers are shown next to each other across the screen. This just serves to keep you on your toes. The response times can be rather long as various numbers are selected by the Dragon, but in general it's faster than playing against a human opponent. It is reasonably well written, but it appears to get into an endless loop if you enter a co-ordinate that is already occupied by a piece. The instructions are clear, and the game is, like all Salamander's efforts, packaged superbly.

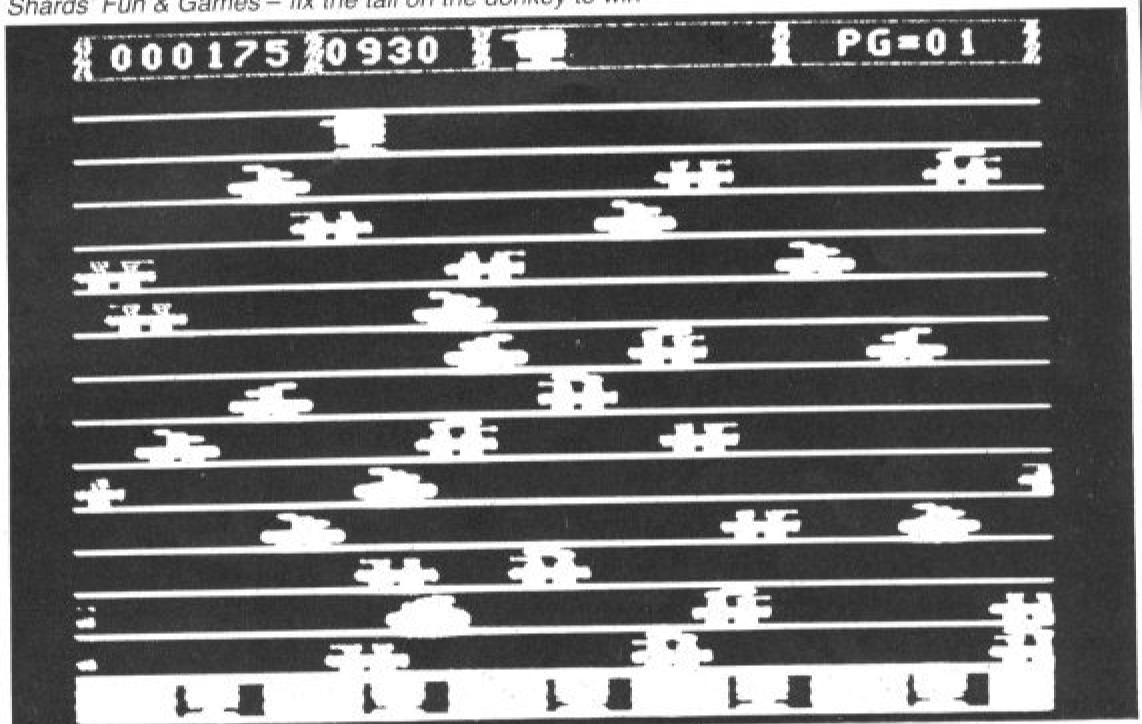
Startrekking

Salamander provides one of the two versions of Startrek both confusingly called Dragontrek. Its version comes complete with a 12-page 'flight manual'. The game originally appeared long before Space Invaders launched themselves upon our TV screens. Indeed, until IBM tightened up its internal security, it used to be a very popular pastime for up-and-coming executives!

The mainframe version used to include



Shards' Fun & Games – fix the tail on the donkey to win



Dragon Data's Rail Runner – a Frogger-type cartridge arcade game

all the usual alternatives — short range and long range scans, photon torpedoes, phasers and shields — but did not usually show on-screen movement. This was due probably to the high incidence of line-printers rather than VDUs as terminals. Salamander's version allows use of a joystick to steer round the galaxy (you select the size), and blast to kingdom come any Klingons you discover lurking in your sector. The Wintersoft version is closer to the original game.

I have to admit that I'd rather watch an episode of Startrek on the TV to playing a watered-down computer version, and the Wintersoft one has little innovation to enthral me. The Salamander version, although costing nearly £10.00, uses far more of the screen and is more interesting to play. It also uses characters from the TV series to inform you of your progress. Unfortunately Lt. Uhuru never gave me the message to come to her cabin, as I hoped she would!

Educational

Although the promised Dragon Data educational programs have yet to make an appearance in my review bundles, one or two other firms supply cassettes that could possibly be considered to be in that category. Gem Software sells a couple of tapes, called Eduquiz I and II. I am somewhat reticent to term these truly educational, as they provide questions on a wealth of subjects without attempting to teach anything. As general knowledge quizzes they are fun, especially as the format is similar to the TV game, Winner Takes All. There are usually five alternative answers offered, and you can gamble your points on different answers. Subjects offered are Geography, Inventions and Kings and Queens on Eduquiz I, with Writers, Painters and Musicians on Eduquiz II. My only criticism is that they are highly priced for text programs at £9.95.

Good educational software is few and far between for the Dragon — simple drill-type programs merely test acquired knowledge and there must be a large market for software that develops thinking skills. I await Dragon Data's efforts with interest. With more quality programs on the market, Dragons could find their way into many classrooms.

There are one or two compendiums on the market at the moment that provide you with a selection of games. I've mentioned before that many of these often contain just one or two mediocre games that give the appearance of being thrown together in a few evenings. When a collection appears that is better value, I try to give it an airing, as I did with B & H Software's Gamestape I last month. This month I was pleasantly surprised by Shards Software's Fun and Games. This contains eight games designed apparently for use at a party.

Crosses is a standard game of Noughts and Crosses and is competent but not out of the ordinary. The graphics, however, are large and clear. The rest of the games improve as the tape progresses. The next one is a version of Mastermind (the colour-code breaking game rather than the Magnus Magnusson version). Gold involves steering a tiny cross round a minefield collecting pots of gold but offers no lasting challenge. Snap shows a sequence of playing cards and allows you to press the space bar when two consecutive cards are the same. The program gives you less time than the average human and you have to be on the ball to beat it.

Anagram, which follows, presents you with jumbled words which make up the names of UK towns and cities. If you're not feeling too bright, you can get the computer to shuffle the letters at random until they give you more of a clue. There are 200 towns held in data statements, so the game could be used as a versatile educational training exercise. Donkey is a good party game — very close to the original. A realistic and colourful animal appears on the screen, and you steer a tail round the screen with a joystick (supposedly while blindfold!). The closer you get, the higher becomes the note from the loudspeaker, and pressing the button fixes the tail. Points are awarded unless you are spot-on, when you are declared the outright winner. Dice is a poker-type game with dice, and Circles relies on memory and estimation skills.

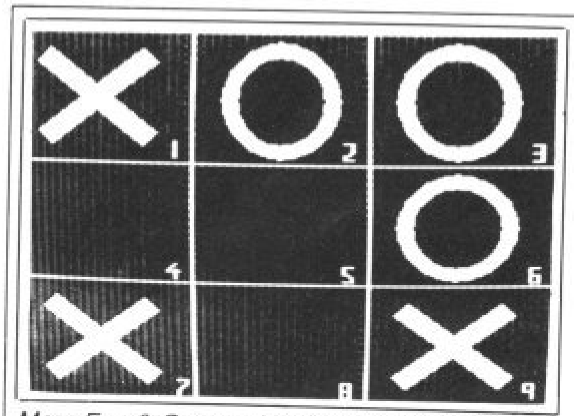
Artist is a very strange program, and should appeal to frustrated Miros and Kandinskys everywhere. Up to four people can select a choice of colour, shape and block preferences, and the Dragon proceeds to draw an abstract random picture. When you are happy with the result, it is stored on a graphics page and the other artists have their turn. At the end, a human or the computer (!) can judge which is the best effort. There is no clue what the criteria for a good picture are, but it seems a little unfair for the computer to judge what is actually its own efforts. It is, however, an amusing concept.

Musical is the last program on the cassette and is essentially just for lazy musical chairs players. It uses the computer to switch on and off a music cassette and keeps track of who falls on the floor. Although by no means the most exciting tape in the review, Shards' Fun and Games does provide for £5.00 a selection of eight entertaining games to liven up a children's party.

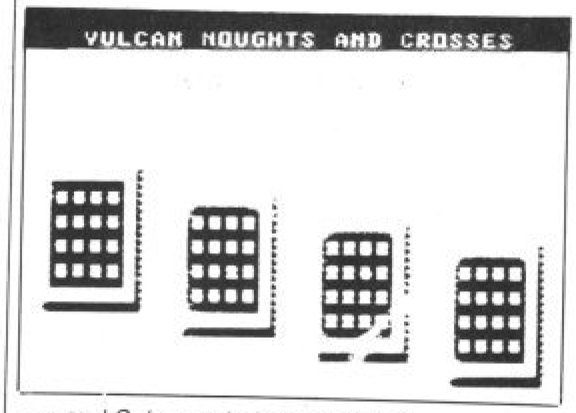
Party closers

Now for two games that you would only produce at a party when you wanted your guests to leave, unless they happened to be war-game fanatics, that is. Some time ago I reviewed the rather blood-thirsty program Samurai Warrior, in which you follow the rules of the Knights of Bushido fairly accurately, ie you can achieve quite a good score by ritually disembowelling yourself — just the sort of game to brighten up a rainy evening.

M C Lothlorien has turned to Ancient Greece for its Tyrant of Athens. Without examining the structure of the games ▶



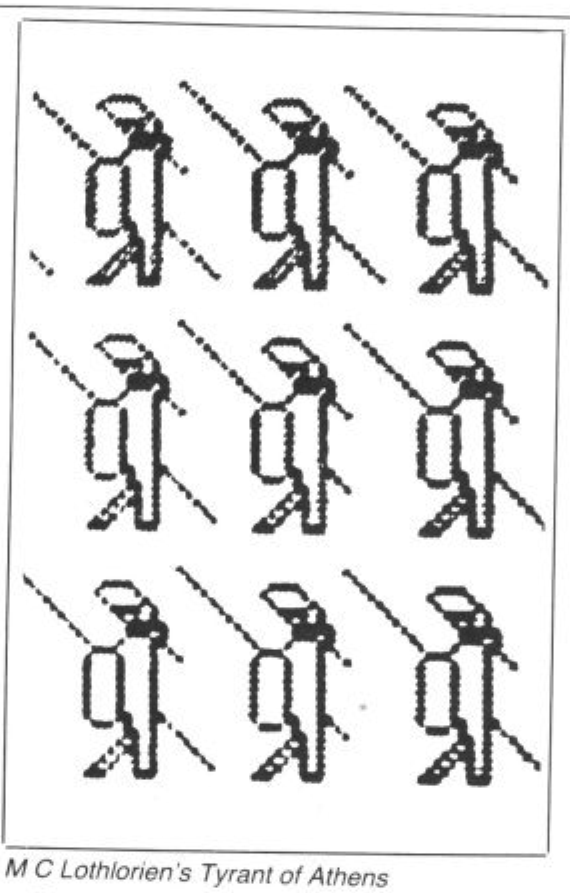
More Fun & Games: Noughts and Crosses . . .



. . . and Salamander's 3-D version

◄ in great detail, Tyrant appears to be similar to Samurai, although it is not quite as gory. You are attacked by various armies and navies from other city states and surrounding countries. You have to balance your forces to defeat them as well as controlling the farming economy. This certainly scores over text-only kingdom/adventure games, in that it uses graphics as well as can be achieved, given the slowness of Basic. There are maps showing you the origins of your enemies and also rather stylised armies or navies bumping into each other. The instructions on the sleeve insert are clear, in fact rather detailed, and the game is certainly not over-priced at £6.95.

Strategic Command from Romik Software is considerably more complicated than Tyrant of Athens. It can, however, be very addictive, and if you happen to be spirited away to Roy Plomley's island paradise, then you could add this program to the Works of Shakespeare and the Bible — it would certainly keep you occupied for hours — if only working out the complicated instructions.



M C Lothlorien's Tyrant of Athens

A map appears on the screen showing the islands upon which you and your opponent do battle. You move land and sea forces with your joysticks until they are close to each other. At this point the forces you have at your command are shown in silhouette on the screen. You don't play against the computer, but it does have the final decision on the state of play. Eventually (two hours later, in my case!) you may reach your opponent's capital and become the winner. I found it the most complicated original computer game I have played, being something like a cross between Diplomacy, Risk and a true war game.

I would not recommend this to anyone without a lot of patience to cope with the pages of rules, but if one day, you find yourself on a desert island, who knows . . .?

Should your desert island be a reasonable size, you could practise your bunker shots all day. This brings me rather deviously round to the next set of games. There are two golf programs included here (Salamander's rather fine but more expensive version was reviewed two months ago).

Golf (£7.95) from Gem Software goes for the more traditional game where you have to know your woods from your irons (the explanations are few and far between). Unkind remarks are made when you choose the wrong one! You need to specify the strength rating and the compass direction of your swing. All this is displayed on a clear bird's eye view of the fairway.

Handicap Golf from Computer Rentals is less expensive at £6.00 and uses a different procedure to hit your ball. You have to enter strength and direction to tee off. Unfortunately, the entry routine was not error-trapped and accidental or deliberate out of range inputs caused the excellent map of the fairway to scroll up which means the ball position bears no relation to its on-screen appearance. This results in some strange games — a sort of tactile version of golf which I'm sure wasn't intentional! Of the two, I prefer the Gem version, but it's still not quite up to Salamander's version in spite of its pleasing graphics.

A new game that is much easier on the brain, although it requires fairly fast thinking, is Flag from Dragon Data. A field of hexagons appears on your screen and you can plan a human opponent or the computer. The object is to reach the other side of the playing area and capture a flag. Obstacles appear in your path at random, and the winner is the first player to capture three flags. Although an original computer game, it is reminiscent of a board game I played some time ago, and in spite of being well written, it doesn't really use the potential of the Dragon.

Loading

All these games loaded first time — I'm not sure if manufacturers are improving duplication techniques or whether it's due to my using a new Superscope C190 cassette recorder — although expensive at nearly £40, it's a model I'd recommend to anyone.

In spite of intending to restrict the theme of this review to intellect-testing games, there is a new cartridge from Dragon Data that deserves an honourable mention. Rail Runner is a Frogger-type arcade game that puts you in the role of helping five Herman Hobos across a multi-track rail-yard. You control a figure named Bill Switchman who must cross the busy tracks and rescue the poor unfortunates from the bottom of the screen. Cursor keys are used in this fast-moving game and although I have reservations on the price — like all cartridges it seems over-priced at £19.95 — it is a game that needs fast fingers and a careful strategy to succeed.

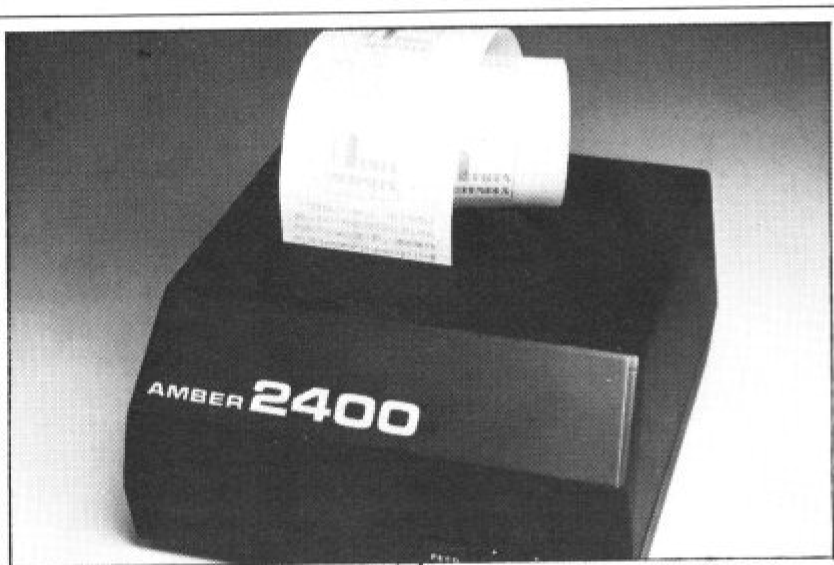
There is certainly a wide range of software available for the Dragon at the moment, and a lot of it uses the graphic and sound potential of the computer well. It's good that at long last Dragon owners have a wide choice, almost as wide as that for any other computer. Now I'm off to hide from the editor for the next month while I sample a new collection of adventure games. ■

Software reviewed this month

Escape £8.00	Microdeal 41 Truro Rd St Austell Cornwall	**Vulcan Noughts and Crosses** £7.95 **Dragontrek** £9.95	Salamander Software 27 Ditchling Rise Brighton E. Sussex
Deadwood £6.90	A & F Software 830 Hyde Rd Gorton Manchester	**Eduquiz I** **Eduquiz II** both £9.95 **Golf** £7.95	Gem Software Unit D The Maltings Station Rd Bishops Stortford
Strategic Command £9.95	Romik Software 24 Church St Slough Bucks	**Fun & Games** £6.00	Shards Software 10 Park Vale Court Vine Way Brentwood Essex
Golf £6.00	Computer Rentals 140 Whitechapel Rd London E1		
Flag £7.95 **Rail Runner** £19.95	Dragon Data Kenfig Industrial Estate Margam Port Talbot West Glamorgan	**Tyrant of Athens** £6.95	M C Lothlorien 4 Granby Rd Cheadle Hume Cheadle Cheshire

Picking a printer

*Looking for a printer for your Dragon — **Stephen Adams** gives you a helping hand by examining six of the best.*



Amber 2400 – print is clear and paper is cheap, plus no inky fingers

THE DRAGON HAS a socket on its left-hand side for a 'Centronics' printer. This review looks at six printers which can be used: the Olivetti JP101, Seikosha GP100A, NEC 8023, Amber 2400 and two models from Epson — the FX80 and RX80.

The first thing to understand about the 'Centronics' interface is that all the data is presented in 'byte' form, eight bits at a time over eight wires. There are also some control signals and protective earth screens to be connected up between the printer and the Dragon. On the printer there is a standard 36-pin Amphenol socket, but on the Dragon there is only a 20-way socket, so a specially made up cable must be bought to connect the two.

It also means that some of the facilities of the printer are not available as they are unconnected. These do not affect the operation of the printer, but are warnings — such as paper empty, errors, and an input to restart the printer after an error. The restart can be done by just turning off the mains switch on the printer, so it is not required by the average user.

All of the printers use the ASCII code and therefore have special uses for all the codes under decimal number 32. These can be used to implement such things as graphics, special features of the printer and formatting letters.

A great deal of the features on any printer are implemented by control codes using the escape code. This is CHR$(27) on any printer and can be followed by any number of codes depending on the application. It is not a printable character and so must be put out as a separate character to the printer. Any other control codes, as they are called, must also use this method as they may confuse the Dragon if PRINTed to the screen.

PRINTing to the printer rather than to the screen is by the command PRINT#−2, followed by the CHR$ or strings you want to print. Page 132 of the Dragon user manual has a brief description. Any number from 0 to 255 can be put out to the printer by using CHR$(X); and so all of the printer controls are available. The most important of these is the CR code (carriage return) which is set by most printer manufacturers not to print on a new line, but to just return the print head to the start position.

The Dragon, however, requires that the CR code produces a LF code (LINE FEED) action as well when it LLISTs a listing to the printer. Dragon users must first find out in the manual where the selection switches are so that this can be done. These selection switches contain the way the printer is set up when switching on and also select the character set (English, American, etc), CR action, etc. On the Seikosha model they can also start up on self-test which prints out the entire character set continuously.

The differences between the various character sets is minimal and only requires the changing of a few characters. All the characters are from 32 to 127 in the ASCII character set and printer manufacturers have sometimes used the other 128 characters for other purposes. On the NEC, for instance, there is a set of graphics, Greek letters, etc; on the JP101, though, these codes are unused which seems a pity.

Graphics are available on all the machines reviewed and apart from the Seikosha all eight bits specify eight dots on the printer (either vertically or horizontally). The Seikosha only prints on a 5 × 7 pin format and so can only print seven dots in a column as against the normal eight. The eighth bit is always a '1' to indicate graphics data. The way of implmenting the graphics feature varies from machine to machine: it is easiest on the Seikosha and most difficult on the Olivetti.

The printing typeface is obviously very important to the final result and the greater the number of pins used to make up one character, the better the result should be.

Amber 2400

A special cable is needed to connect up the Amber 2400, which has a 25-way 'D' socket instead of an Amphenol. The Amber is one of the cheapest plain paper printers around. It is also quite small (6 × 6 × 3 inches) and its neat black box has only one control on it. This is for paper feeding when not printing — pressing it while printing jams up the printer, so you have been warned! The paper feed also initiates a self-test if the printer is switched on with paper feed pressed. A power on LED is also fitted.

The main problem with the Amber is its greatest asset, namely its size. The maximum number of characters per line is only 24 (18 in graphics mode) and this means that it cannot print more than three-quarters of the maximum Dragon screen of 32 characters. This should make no difference on listings because the characters overrun on to the next line, new lines appearing where they should.

The print is very clear, being blue ink from a cartridge ribbon which is very easy to insert — no inky fingers! The paper is only 2¼ inches wide and is very cheap as it is also used by cash tills. A large reel sits in a recess under the printer's cover.

The printer speed is not great at 18 characters a second, but it is ample if you don't want anything fancy. No fancy scripts and the lower case letters do not have proper descenders, ie the bottom half of the p and y does not drop below the line of characters as in this text.

Double width, double height and an indent of one space are the only special features. Double width characters, of course, mean half the number of characters per line can be printed, a maximum of 12. As I said at the beginning this is a cheap printer, but you also get a great deal of restrictions.

Seikosha GP100A

Seikosha's GP100A is a one-of-a-kind printer as it only uses a one pin head to achieve its 5 × 7 matrix character, thus saving money. It also slows up the printer to only 30 characters a second. The paper used is normally tractor fed, driven along by sprockets on either side of the paper engaging in holes perforated in either side. There is an option to use sheet fed paper rolls, but having tried this option I would not recommend it as it tends to pull the paper from side to side.

The set-up switches for the character set, CR, etc are inside the machine, so a screwdriver must be used to unscrew five screws to set it up. It is a pity that manufacturers cannot mount these switches on the outside of the machine.

Putting in the paper is fully explained with pictures — it slips underneath the platen (the piece the typeface hits) quite easily. The paper can be wiggled around to get it lined up properly over the sprockets. Then the covers (which are just like wings when opened) can be pushed down over the paper holding it securely. The paper can be advanced forward by turning a knob on the top. The ribbon is a 10-inch long band with two capsules on each end, one holding an ink pad which ▶

Dragon Dungeon

NUMBER ONE FOR THE DRAGON

DRAGON OWNERS CLUB

The Dungeon is also the home of the largest Dragon Owners Club in the UK (or, since members are scattered through Europe to Africa and the Middle East, should we say "the world!)

The club magazine, *Dragon's Teeth,* is published monthly and includes news, reviews, advice and information exchange for dedicated Dragon-bashers. Free members' adverts, monthly offers (some members have already saved the cost of their subscription), competitions and, for extrovert Dragonards, badges and bomber jackets.

LATEST DRAGONWARE

ARCADE GAMES: 'Mined Out' (Quicksilva) £5.95, 'Dragonhawk' (Pentagon) £6.95, 'Vultures' (Dragon Galaxians, Morrison) £6.95, 'Droids' (great new action game, Morrison) £6.95, 'Drone' (Tron-type game, Cable Software) £8.75, 'Spider' (Premier) £4.95, 'Bopswizzle' (beat the Gloops, Smoochers and Yerkles!) £5.95, 'Scanner' (an entirely new style of arcade game by Bamby) £8.45, 'Sniper' (Soft Joe's) £6.50.

Watch out for the best arcade game yet — Programmers' Guild's fantastic 'Ninja Warrior' (17 screens!). In stock shortly.

ADVENTURES: 'Alien Oddessy' (the first two parts of a giant 60K-plus saga) £9.95, 'Into the Labyrinth' £7.95, 'Danger Island' £6.95, 'Chateau' £7.95, 'Jungle Search' £6.95, 'Volcanic Dungeon' £5.00.

Best-seller still Wintersoft's mammoth 'Ring of Darkness' £10.00.

JUNIOR PROGRAMS: 'Baby Dragon' (Teddy Bears' Picnic and Koko the Clown) £5.95, 'St George and the Dragon' £6.95, 'Pirate' £8.50, Infant Pack (pre-school letters and numbers) £3.95, Action Pack (mazes and simple arcade) £3.95.

UTILITIES: Editor/Assembler/Monitor cartridges and manuals: Compusense £30.45, MACE £29.95, RS232 Interface Unit £49.50, Monitor Sound Unit £37.50, Salamander Graphics System £9.95.

BOOKS: 'Dragon Extravaganza' £4.95; 'Making the Most of Your Dragon' (highly recommended) £5.95, plus 50p postage; 'The Power of the Dragon' £5.95, plus 50p postage; 'Learning to use the Dragon 32' £4.95; 'Dynamic Games for the Dragon 32' £4.95; 'Know Your Dragon' (a friendly introduction to a friendly computer) £5.95.

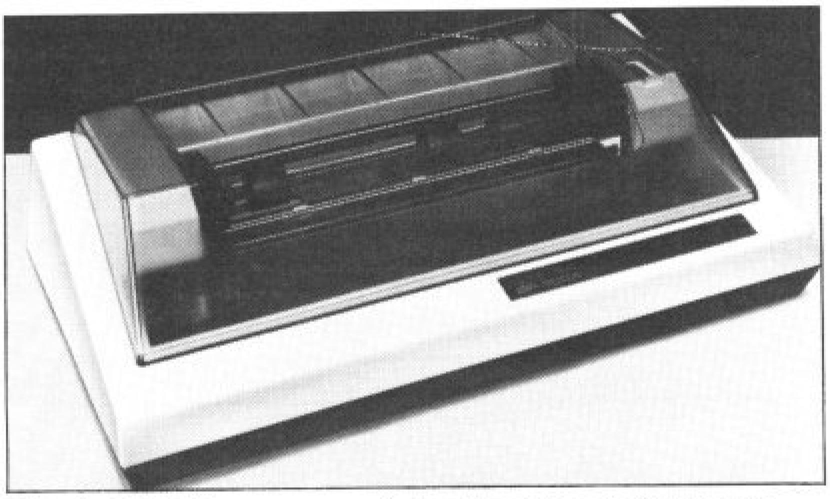
Annual Membership: £6.00
(£8.00 overseas)
Six-month Trial Sub £3.25
(£4.25 overseas)



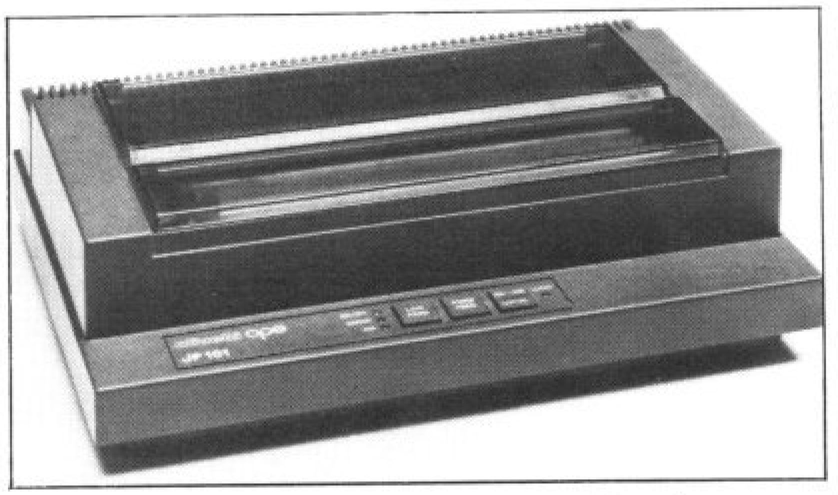
Top quality double potentiometer joysticks for the Dragon owner who demands arcade action Ultra-sensitive, but tough and reliable, Dragon Sticks will keep on zapping when others fail! £19.95 per pair inclusive VAT and postage.



P.O. Box 4, Ashbourne, Derbyshire, DE6 1AQ. Tel: (0335) 44626



Seikosha GP100A – uses a one pin head to achieve its 5 x 7 matrix



Olivetti JP101 – uses a glass tube filled with a graphite rod

◀ inks the ribbon as it goes round in a continuous circle. The two containers have to clip on to two holes at either end of the machine and then you have the fiddly job of slipping the ribbon over the print head between it and the paper. The paper width can be between 10 inches (hence GP100) and 3 inches, making it ideal for most jobs from continuous labels to word processing. The paper comes in boxes of 2,000 sheets; some retailers are, however, giving away 500 sheets free with every printer. Each sheet is 11 inches by 8½ inches, excluding the holes on either side.

The print was very faint on the printer I received due to the ink having dried out in transit — fresher ink capsules can make the print a lot clearer. The characters have no true descenders, but the graphics are easy to use as only one character (a back space, code 08) is required before graphics data is sent. Mixed data and graphics can be used on the same line. No special typefaces or controls are available on this printer, but the foreign characters are available above decimal 128 in the character set. This is a fairly cheap, full-sized, plain paper printer which is easy to use — a good first printer.

Olivetti JP101

The Olivetti JP101 spark ink jet printer is another unique printer as it uses no ink ribbon at all, but a glass tube filled with a graphite rod. This ejects a graphite dot on to the paper via a high voltage spark. This means there is no chance of smudging the paper, no messy ribbon to fit and a faster print rate (50 lines a minute). It also means, unfortunately, a poor print quality — the resulting print looking as if it was done with a HB pencil. A test print is supplied with every machine, using the self test mode of holding down the LF and FF (form feed) switches at power on. The paper is easy to slip on to the tractor which can only move from 8 to 10 inches. An alternative friction feed is built in and works smoothly to cope with smaller widths of paper.

One annoying thing is a cover alarm which goes off in an ear piercing yell every time you want to see what is going on underneath the opaque cover that covers the print head and rollers. In the end a piece of paper jammed in the switch prevented this safety device stopping the printer.

Characters have true descenders and special features can give you up to 147 characters at 18.33 an inch. The other features include horizontal and vertical tabs, three-way underlining, double height and width. The graphics set up is quite complicated, but it can be doubled in size by a zoom feature which prints every dot vertically and horizontally twice. A circuit diagram and layout is also included (which is unusual) as well as plenty of pictures showing how to set up the printer.

There is a built-in 1K of memory which allows faster printing as the Dragon does not have to stop for the slow speed of the printer. Also it prints in forward and reverse directions with a Z80A CPU for skipping over spaces to cut down the time it takes to print characters.

There are four indicators, power, local (printer disconnected from the control of the Dragon), error and ink (which gives a warning that the ink capsule is nearly used up). The three switches apart from the on/off one on the side are local, LF and FF. The last two only work when the printer is in the local mode (LF advances the paper by one line and FF by a whole page of 11 or 12 inches).

Again the set up switches are located inside the printer.

```
10 PMODE4,1:SCREEN1,1:PC
LS5:COLOR0,5
20 FORI=1TO1000
30 X=X+L*SIN(R):Y=Y+L*CO
S(R)
40 IFX<-128ORX>128THEN90
50 IFY<-96ORX>95THEN90
60 LINE-(X+128,Y+96),PSE
T
70 R1=R1+60:R=R1/57.2957
8:L=L+0.5
80 NEXTI
90 REM PRINTER ROUTINE
100 OPEN"O",#-2,"0/P"
110 FORY=0TO191
120 PRINT#-2,CHR$(17);
130 FORX=0 TO 17
140 A=0:B=128
150 FORZ=1 TO 8
160 IFPPOINT(X*8+56+Z,Y)
=0THENA=A+B
170 B=B/2
180 NEXT Z
190 PRINT#-2,CHR$(A);
200 NEXTX:NEXTY
210 END
```

The Amber gives 24 characters a line

The JP101 has the facilities, but not the print quality to give the Dragon a decent printer, even with the contrast control on full. When the technique has improved to give a 'blacker' print it may be worth considering.

NEC PC8023

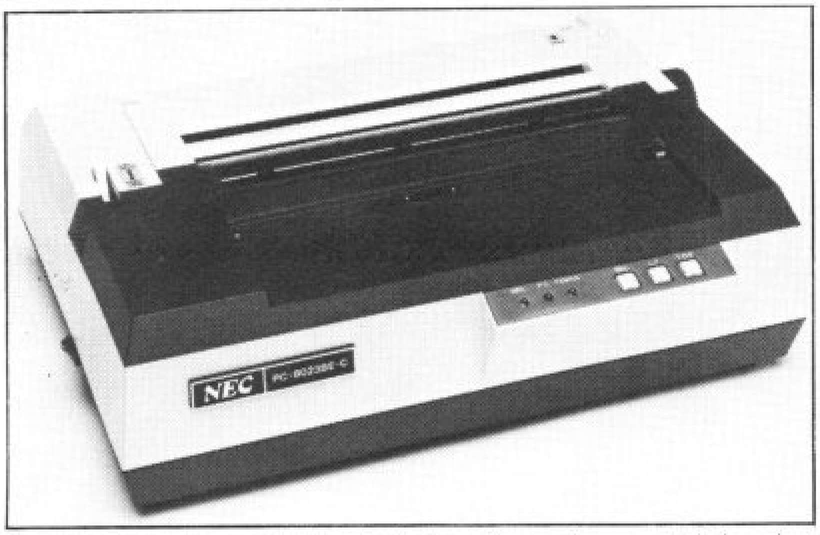
The first thing you notice about the NEC PC8023BE is that it is heavy (8.5Kg) and built to take a lot of punishment. The mechanism is designed on a strong metal chassis and has an enormous print head compared to the other models tested. The PC has friction feed and tractor feed to take paper up to 10 inches in width, the minimum size being 3 inches. The paper is fed in through the top cover at the back of the printer and straight on to tractor sprockets (if used). It is then fed under the platen and is held in place by a very lightly sprung bar.

The ink cartridge is also large and unique to this printer — 4½ inches square it travels on the back of the print head. The ribbon is also twice as wide as normal as it uses the top and bottom as two separate ribbons. It is very noisy even with the clear plastic cover over the printer platen. The switches to control the character set, CR and other functions are included underneath where the printer runs, covered by a clear plastic strip. There are sixteen switches in all, each one explained in a table showing the on and off results.

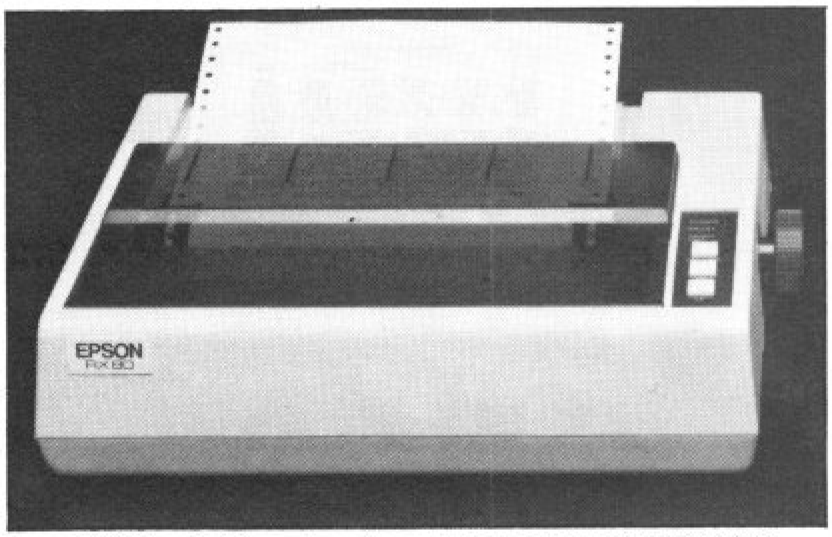
This speedy machine has a buffer RAM memory. No size was given, but it carried on printing for a good 14 seconds after the Dragon had finished LLISTing. It also prints both ways and uses logic seeking to find the next character to print. The print speed is 100 characters a second.

On the front of the machine are three LEDs: SEL (on line/local), paper empty and power. The three switches on the top are SEL, LF and FF. An on/off switch is located at the side. The only problem I had was getting off the main cover to look at the ink cartridge ribbon as it was very stiff. The paper cover on the other hand comes off very easily. The character set includes Greek and most European languages as one would expect, but it also includes a graphics set. This consists of blocks, lines and curves based on what looks like the Pet character set.

This printer has wide variety of print modes with proportional spacing ▶



NEC PC8023 – the mechanism is designed on a strong metal chassis



Epson RX80 – six different modes and most can be mixed together

◀ It prints up to 136 characters and down to 48 characters. Each ESC (code 27) code has a four to 10 line description of what the command does and in the back is a six-page Basic program to demonstrate all the possible modes. These include setting line spacing down to 1/144th of an inch, horizontal and vertical tabs, start position and graphics.

The character set has proper descenders and is very clear when printed on its 7 × 9 matrix (8 × 8 for graphics). The only problem might arise when programming some commands as the numbers for such things as tab settings and length of graphics bytes are given as decimal. So a setting between 0 and 999 would require three bytes to be sent, one for each number from 0 to 9.

The manual is clear, but brief on most subjects, the only pictures being at the beginning. It was obviously designed to work with NEC PC8000 series of computers and although noisy should last a long time and give good service. The only problem could be spares as everything on the printer is fairly unique and it could be superseded before it reached the end of its working life.

Epson RX80

The RX80 is the latest in a series of dot matrix printers from Epson. It and its brother the FX80 have now taken over the lead set by the MX80 and MX100. These cream boxes contain a very sophisticated printer for the price, with one of the best print qualities I have ever seen on any printer. The RX80 comes with only tractor feed from 3 to 10 inches with no option for friction-fed sheet paper or rolls.

Again the printer setting up switches are buried inside the machine and page iii of the manual warns "the case should only be opened by a service person". Then after showing how to remove shipping screws, insert the ribbon cartridge (which is as long as the machine is wide) and load the paper, it goes on to explain how to remove the top part of the case! This is not as easy as it looks and may have some people wondering if they are going to rip the case apart before getting the top off.

The settings allow you to change the character set, prevent the end of paper detector stopping the printer (to squeeze every inch out of the paper), CR and, if you want, HX20 graphics characters in the codes 128 to 159. Also it sets the print mode to condensed (132 characters a line) or pica (80 characters a line). The print mode can also be selected by software through the ESCAPE code sequences listed in the manual.

There are six different print modes and most of them can be mixed together to give multiple effects. For instance you can have enlarged, pica sized, italic or double struck characters. All characters have true descenders and when double strike is used the space between the dots printed by the print head is filled in by going over them again. This makes the print look like a fairly decent typewriter. The escape control codes all have a page or more explanation on them, with print examples and a program in Microsoft Basic to try them out. The characters can be printed in super or subscript (as in chemical formulae where tiny letters are mixed with normal ones), and the line spacing can be set to n/216ths of an inch.

Vertical and horizontal tabs as well as form length can be specified, plus the margins on each side. There are 46 different escape commands including six different bit graphics modes. These allow you to draw pictures by specifying the individual dots on the printer. A good example of a computer 'photograph' is also shown in the manual to illustrate the point. The graphics require a lot of escape codes to use them, but you can mix text and graphics on the same line. The graphics *must* be done without the CR doing a LF, so it's back inside the machine to change the switch setting.

The print quality is excellent, even in the graphics mode which usually shows up errors in the print head movement. The print head can be replaced quite easily by unplugging it from the PCB socket under the platen and pulling the head from the travelling holder. This and general cleaning are all the maintenance required.

If you don't want friction fed paper and have the money, this is the printer to buy.

Epson FX80

The FX80 is more expensive than the RX80, but has all the same features, plus a lot of extras. There is a user definable character set of 255 characters, and 2K of RAM buffer (which allows the computer to be released from printing quicker) if you do not use the user definable characters. Proportional spacing is possible so you get what looks like joined up writing. A higher density graphics print mode, reverse line feeding, friction feed and tractor feed are standard, but the tractors are restricted to 9½ to 10 inch wide paper unless you buy an optional extra. Unfortunately, the paper holders for friction feed are also optional extra.

At least the switches are under a cover which is easy to remove and change.

The RX and the FX80 both have a self test facility and also can dump all bytes received as hex on to the paper for fault finding. The printer has to be switched off before you can get back to text, however.

A smooth worker, the FX80 costs more, but some daisy wheels would have trouble reaching its quality.

Note that the prices quoted in the table are recommended retail excluding VAT. Street prices will be lower. Thanks to the manufacturers for supplying the printers, and to DRG Business Machines for the Seikosha model. ■

Printers reviewed: from £88 to £438

	Characters a second	Tractor	Friction	Dot matrix	Descenders	Maximum characters a line	Proportional spacing	Minimum line space	Price	Telephone contact
Amber 2400	18	No	Yes	5 × 7	No	24	No	1/20	£88	(0264) 65951
Seikosha GP100A	30	Yes	Option	5 × 7	No	80	No	1/10	£215	(0934) 415398
Olivetti JP101	77	Yes	Yes	7 × 7	No	147	No	1/8	£350	01-785 6666
NEC 8023	100	Yes	Yes	7 × 9	Yes	136	Yes	1/144	£395	01-388 6100
Epson RX80	100	No	No	9 × 9	Yes	137	No	1/216	£298	01-902 8892
Epson FX80	160	Yes	Yes	11 × 9	Yes	137	Yes	1/216	£438	01-902 8892

Dragon's giant strides

*Tony Clarke talks to **Graham Cunningham** about Dragon Data's future as the company prepares to attack new markets at home and abroad.*

WHEN YOU step into a taxi outside Port Talbot railway station, the driver says: "You must want Dragon Data." A lot of people want the Welsh company at the moment, both at home and in the US, as it expands the range of machines it offers.

By this time next year Dragon Data plans to be marketing four microcomputers, moving up gradually to attack the business market. The first step is the smallest one: a CPU swap for the Dragon 32 giving users 64K of RAM. But after that the steps get bigger and bigger: the Dragon 64 will be followed by a £400 machine and a £2,000 business model next year.

The guiding force behind these moves is managing director Tony Clarke — standing about 6 foot 4 inches tall he expects to be able to take them all in his stride.

A computer enthusiast as well as a businessman

One of the other striking things about Dragon Data's managing director is that he is an enthusiast as well as a successful businessman. While promoting the merits of the company's disk drive system he extols in detail the Western Digital controller chip it uses. Similarly conversation about the £400 machine moves into discussion of the NEC 7220 GDC.

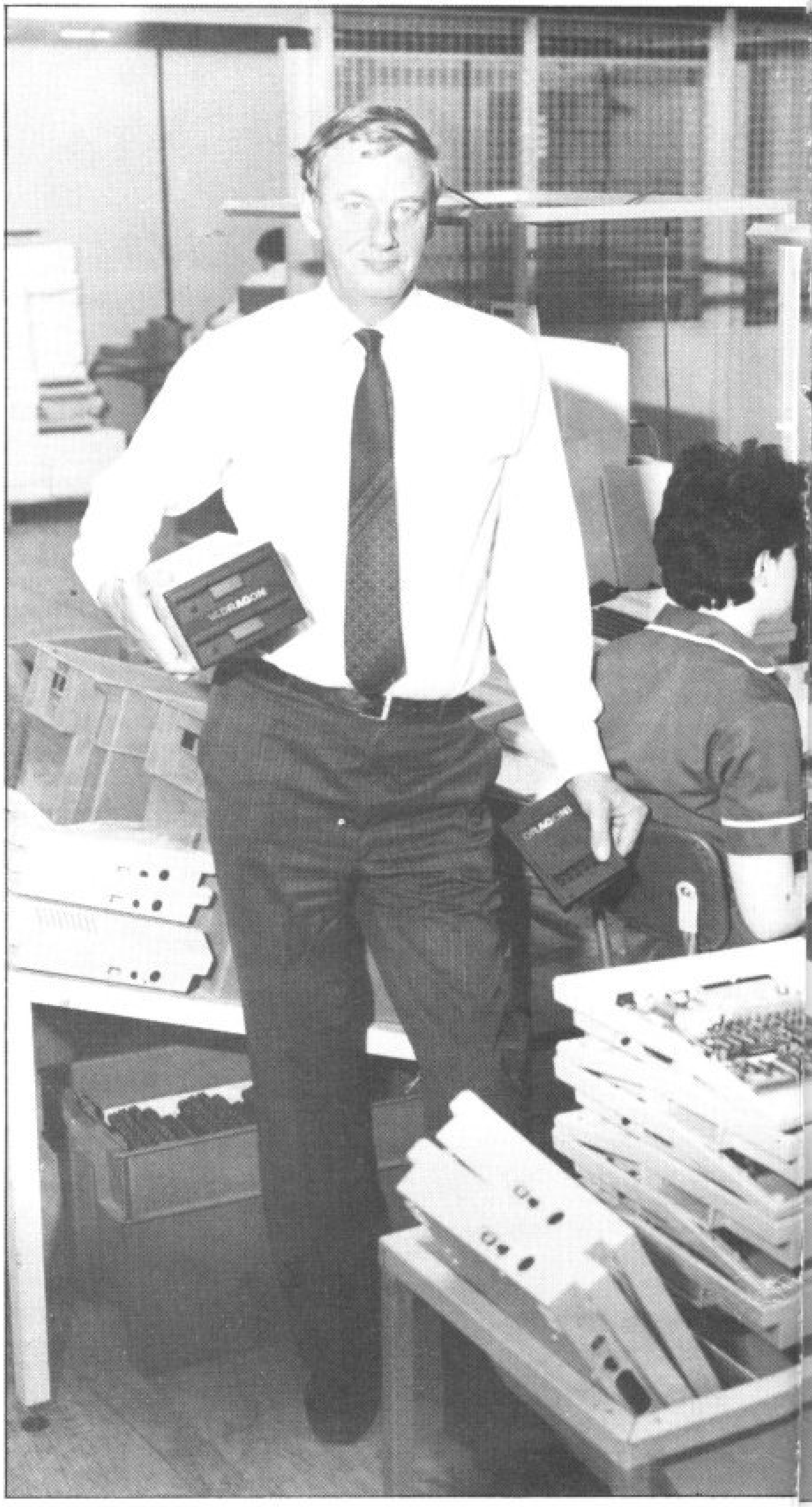
And this enthusiasm spreads further than semiconductors. Talking of the business market, Tony describes network configurations and procedures to provide the automated office of the future. This includes Mumps, a little known operating system which began life, as its name suggests, with medical applications but has moved into the business market on such machines as Digital Equipment minis.

Also covered are the virtues of easy to use systems such as Apple's Lisa and Xerox's Star incorporating mouse devices. These are desktop controllers which can be used to move items displayed on a screen. Microsoft, whose Extended Colour Basic is used on the Dragon 32, has recently introduced a mouse for use on its Multi-Tool word processing system.

And in the office outside his own sits a range of machines which he will take apart and examine. Elsewhere in the company various models — including micros, minis and computer-aided design systems — are being put through their paces in practical applications.

As far as the business goes, Tony has a personal stake in the success of Dragon Data. The company began life as a subsidiary of Mettoy in the spring of 1982. In November a consortium, including Tony, was formed to purchase the firm which moved to a new factory in south Wales. Since then Dragon Data has become the largest privately owned company in Wales, and is set to grow even faster as the new products are launched and new markets are attacked.

The summer launches—the CPU swap and the disk drive system — immediately move the Dragon 32 into new markets as they introduce the



Tony Clarke – introducing OS9 on the new Dragon Data disk drive system, and hea

OS9 Unix-like operating system from American software house Microware.

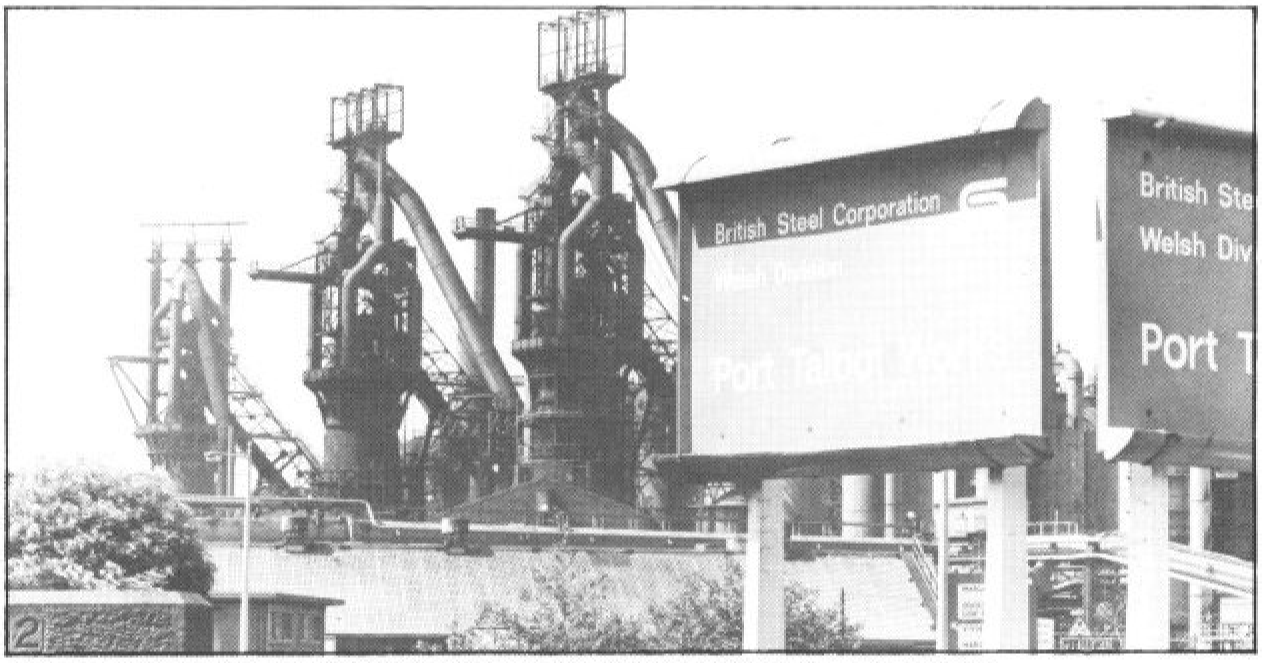
This is a multi-user, multitasking system for small business users which has a very high reputation in the US — so high that some observers have suggested, tongue-in-cheek, that it is "too good" for home computers such as the Dragon. This hasn't prevented other micro manufacturers, such as Tandy and various Japanese firms, choosing it. Another British company, Positron, uses it on its £1,000+ 9000 system.

As a newer operating system it has less applications software available for it than more established systems such as CP/M, but a lot of languages are already around, including Basic, Pascal and Cobol. C compilers are also available which provide a high degree of software portability across different languages.

Microware says that "OS9 combines the same friendly system interfaces found in Bell Laboratories' Unix operating system with an efficient, modular design that is eminently practical for use with an advanced 8-bit processor." And it adds: "In the future, there will be upward-compatible versions for the Motorola 68000 processor."



, and heading west



Port Talbot's traditional employer, the steel mill, is struggling while Dragon Data thrives.

Microware software is already being used by a wide range of customers, including Eastman Kodak, General Electric, the National Aeronautics and Space Administration (Nasa) and the United States Navy. This is the kind of company Dragon Data is joining.

But not too many Dragon 32 users are expected to be interested in the disk drive system which costs under £300 at entry level and about £500 with two drives. Tony commented: "We think about 10 per cent of Dragon 32 owners will take the double drive option — more on the Continent."

Demand abroad for the Dragon is strong and Tony says: "It is fast becoming the biggest selling home computer on the Continent." But he added: "It is a different market, with more home owners using the machine at work." He puts this down to labour costs being higher, so micros are used at work to provide information at little extra cost.

Consolidating the new operating system's launch

The introduction of OS9 will be consolidated with the launch of the Dragon 64 in September Tony is sure that "there is a demand for a small business computer that is relatively cheap" and that the 64 will meet this demand. He expects packages including the micro, a monitor and drives to sell for about £1,100.

The 64 will give 5l columns by 25 lines on the screen and will have an RS232 interface. The machine will involve a retailing change for Dragon Data — some 64s will be sold through high street chains like Boots, but more are expected to be sold by dealers as off-the-shelf systems.

An RS232 interface is also a feature of the American Dragons which will be launched this summer, costing about $399, in partnership with Tano Corporation of New Orleans. Tony admits: "We're not expecting to sell millions in the US because there are a lot of machines at that price in the market."

But interest is already high. He took the Dragon 32 to an American computer show last April and about 4,000 dealers made enquiries. Only 400-500 dealers will be involved initially, but this will go up to 1,500 as production rises from a starting figure of 2,000 a week.

The marketing strategy in the US aims to profit from the pricing wars being fought there by the main manufacturers. Tony commented: "We think dealers will be keen because they are losing their profit margins." He added that he expects to lure Commodore, Atari and Texas Instruments dealers.

Tano Corporation, which has 100,000 square feet of manufacturing space, was chosen ahead of five other companies. Its background is in marine automation systems, including a lot of experience using the 6809 chip on which the Dragon 32 is based. And Tano already sells another micro — an Apple look-alike designed in Holland and manufactured in Korea.

Among all this activity, Dragon 32 users are not being forgotten. While plans to launch a printer have been shelved, a cassette recorder guaranteed to work with the Dragon is due out this summer.

Tony explained that "a printer was not very likely at the moment" because good ones were available and the falling value of sterling was creating financial problems when buying from abroad.

Dragon Data's other machines will also be sold in the US. The £400 micro, so far without a name, will be a twin-6809 system stepping up the company's attack on the educational and business markets. In addition to OS9, the intention is that it will run Flex, a longer established operating system which has more applications software available for it.

At £400 the machine is also aimed at the home user, offering improved Basic and high quality graphics. And it will break away from the Dragon 32 mould, looking different to previous machines.

While Tony agrees that there is an overlap between the machines discussed so far, he argues that each has excellent facilities in terms of value for money.

Aiming to achieve a high level of software portability

The appearance of next year's micro will again be different. Retailing at under £2,000, this will offer "a unique bus structure" giving a high level of software portability. Tony added that it will run "68000-based and 8086-based software either individually or both together".

This avoids the problem suffered by early 16-bit users who found themselves short of easily available software. A lot of the development work is already finished for this machine, which Tony expects to sell more of in the US than in the UK.

Dragon Data is expanding its present factory to cope with these plans and negotiating with the Welsh Development Authority for another site. While Port Talbot's traditional employer, the steel mill, is struggling, the microcomputer manufacturer down the road is thriving. ■



Blitz a landing space at speed

Clear the skyscrapers until you have space to land, using Dragon Blitz from ***Damian Clancy.***

THIS IS A machine code game for the Dragon 32. You are in an aircraft flying low over New York with a limited supply of fuel. The aim is to bomb away the skyscrapers until there is a big enough space to land.

You have 50 bombs which you can drop using the enter key. You also have 15 lasers blasts to use. The laser clears a space — it is fired with the clear key.

You can move up using the up arrow key, but each time you do this you use up one of your 50 fuel units. When you have cleared a large enough space to land, you can descend using the down arrow key.

The published listing must be typed in. When it is run it automatically puts the actual machine code into memory and deletes itself. You must then type in:
POKE 27,&H40
This allows the machine code to be saved using the CSAVE command as if it was Basic.

This is more reliable than using CSAVEM and allows the machine code to be saved together with the short Basic controller program. It is advisable to save the original Basic program with the data because if any of the numbers are wrong the program will crash the computer when run.

```
1 DATA 86,32,B7,35,52,B7,35,56
2 DATA 86,0F,B7,35,57,86,3F,B7
3 DATA FF,23,10,8E,00,00,10,BF
4 DATA 35,53,10,8E,07,08,10,BF
5 DATA 35,58,8E,11,FF,86,AA,A7
6 DATA 82,8C,05,FF,26,F9,10,BE
7 DATA 01,12,1F,20,86,8C,1F,03
8 DATA 86,20,B7,04,10,8E,11,DF
9 DATA 1F,12,B6,04,10,E6,C6,86
10 DATA 69,C4,3F,5C,A7,20,31,A8
11 DATA E0,5A,26,F8,86,55,A7,20
12 DATA 30,01,7A,04,10,26,E1,8E
13 DATA 07,04,A6,00,81,AA,10,26
14 DATA 02,28,A6,88,20,81,AA,10
15 DATA 26,02,1F,A6,88,40,B1,06
16 DATA AC,10,26,02,15,8C,11,9F
17 DATA 10,2E,02,E2,34,74,0F,87
18 DATA 86,FF,8E,01,51,A7,80,8C
19 DATA 01,5A,26,F9,BD,BB,E5,35
20 DATA 74,81,5E,10,27,00,71,81
21 DATA 0A,10,27,00,96,FD,04,15
22 DATA 1F,10,C4,20,C1,00,10,27
23 DATA 00,89,B6,04,15,81,0D,10
24 DATA 27,00,98,81,0C,10,27,01
25 DATA 56,10,BE,35,53,10,8C,00
26 DATA 00,10,26,00,B4,86,5A,A7
27 DATA 00,86,6A,A7,1F,86,AA,A7
28 DATA 1E,86,56,A7,88,20,86,59
29 DATA A7,88,1F,86,AA,A7,88,1E
30 DATA 86,55,A7,88,40,86,55,A7
31 DATA 88,3F,86,AA,A7,88,3E,30
32 DATA 01,10,BE,35,58,31,3F,10
33 DATA 8C,00,00,26,F8,10,8E,07
34 DATA 08,10,BF,35,58,16,FF,52
35 DATA 8C,07,60,10,25,FF,AA,B6
36 DATA 35,52,81,00,10,27,FF,A1
37 DATA 7A,35,52,86,AA,A7,1F,A7
38 DATA 1E,A7,88,1F,A7,88,1E,A7
39 DATA 88,3F,A7,88,3E,30,88,80
40 DATA 16,FF,86,86,AA,A7,1F,A7
41 DATA 1E,A7,88,1F,A7,88,1E,A7
42 DATA 88,3F,A7,88,3E,30,88,60
43 DATA 16,FF,6E,10,BE,35,53,10
44 DATA 8C,00,00,10,26,FF,62,B6
45 DATA 35,56,81,00,10,27,FF,59
46 DATA 7A,35,56,1F,12,10,BF,35
47 DATA 53,86,0F,B7,35,55,10,8E
48 DATA 06,A4,10,BF,35,58,16,FF
49 DATA 40,10,BE,35,53,86,AA,10
50 DATA 8C,11,DF,10,2E,00,2A,A7
51 DATA 20,A7,A8,20,31,A8,40,A6
52 DATA A8,20,81,AA,26,30,86,88
53 DATA A7,20,86,A2,A7,A8,20,A7
54 DATA A8,40,10,BF,35,53,10,8E
55 DATA 06,A4,10,BF,35,58,16,FF
56 DATA 14,86,AA,A7,20,A7,A8,20
57 DATA A7,A8,40,10,8E,00,00,10
58 DATA BF,35,53,16,FE,FF,C6,0A
59 DATA 34,04,86,40,B7,FF,24,C6
60 DATA 64,5A,C1,00,26,FB,4F,B7
61 DATA FF,24,C6,64,5A,C1,00,26
```

Continued on page 27

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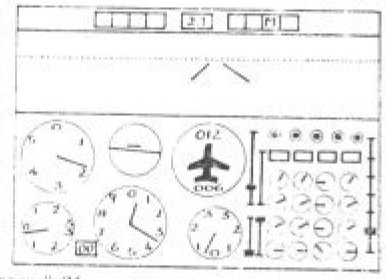
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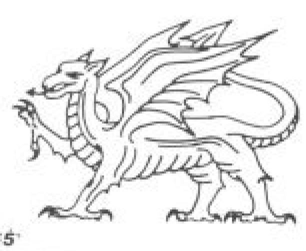
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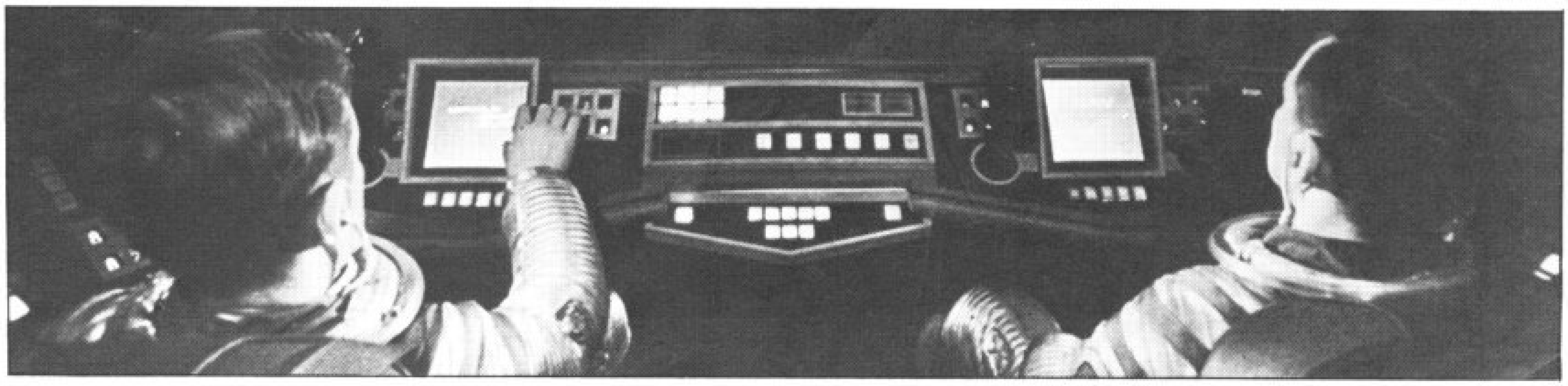


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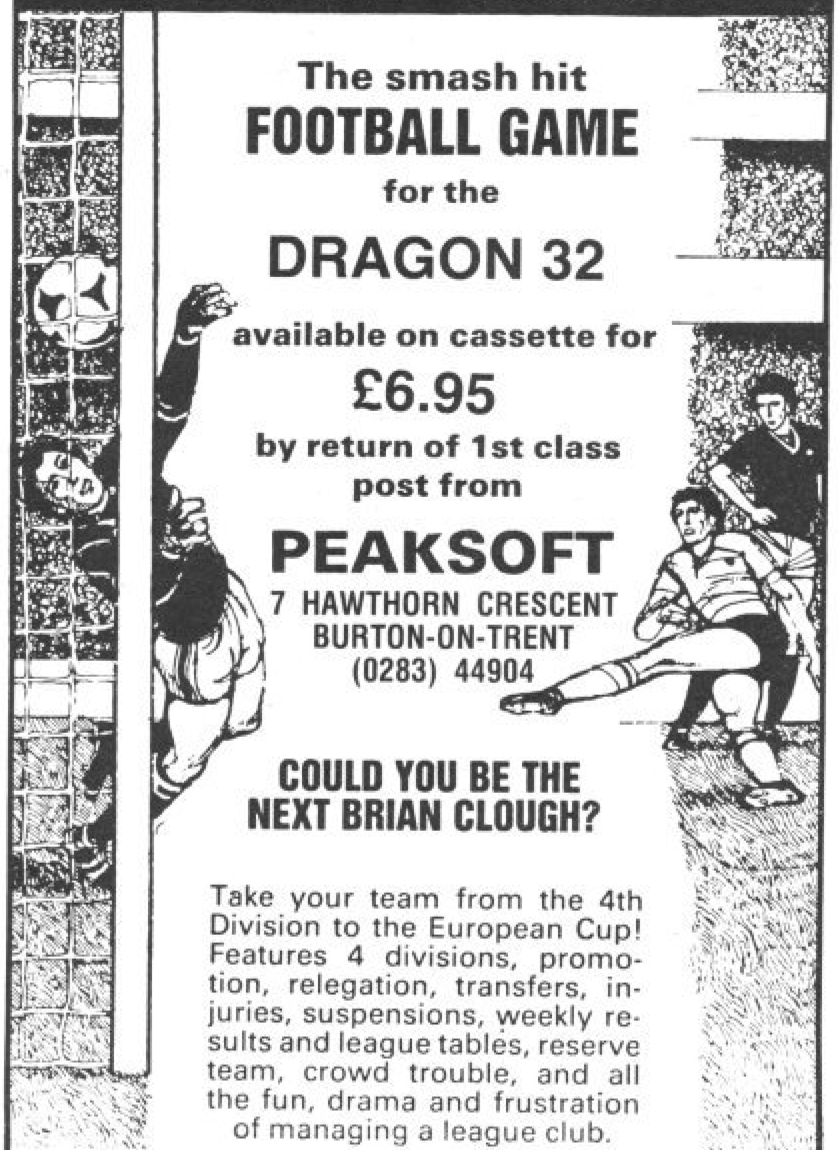
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63 DATA CE,01,F4,FF,35,58,7A,35
64 DATA 55,B6,35,55,81,00,10,26
65 DATA FF,9C,86,AA,A7,20,A7,A8
66 DATA 20,A7,A8,40,10,8E,00,00
67 DATA 10,BF,35,53,16,FE,B6,B6
68 DATA 35,57,81,00,10,27,FE,A1
69 DATA 7A,35,57,86,00,A7,01,A7
70 DATA 02,A7,03,A7,04,A7,05,10
71 DATA 8E,00,FA,C6,14,F7,3F,8C
72 DATA 7C,37,8C,F6,37,8C,5A,C1
73 DATA 00,26,FB,86,40,B7,FF,24
74 DATA F6,37,8C,5A,C1,00,26,FB
75 DATA 86,00,B7,FF,24,31,3F,10
76 DATA 8C,00,00,26,DB,86,AA,A7
77 DATA 01,A7,02,A7,03,A7,04,A7
78 DATA 05,A7,88,21,A7,88,22,A7
79 DATA 88,23,A7,88,24,A7,88,25
80 DATA A7,88,41,A7,88,42,A7,88
81 DATA 43,A7,88,44,A7,88,45,16
82 DATA FE,37,2D,00,00,00,31,0E
83 DATA 07,08,10,8E,12,00,A6,A2
84 DATA 81,69,10,27,00,BE,81,55
85 DATA 10,27,00,BD,86,55,A7,20
86 DATA 10,8C,06,00,26,E8,30,88
87 DATA DF,86,FF,A7,00,A7,88,1F
88 DATA A7,88,20,A7,88,21,A7,88
89 DATA 3D,A7,88,3E,A7,88,3F,A7
90 DATA 88,40,A7,88,41,A7,88,42
91 DATA A7,88,43,A7,88,5F,A7,88
92 DATA 60,A7,88,61,A7,89,00,80
93 DATA C6,3C,10,8E,00,01,10,BF
94 DATA 37,8C,1F,98,84,07,81,00
95 DATA 26,03,7C,37,8C,10,BE,37
96 DATA 8C,31,3F,10,8C,00,00,26
97 DATA F8,86,40,B7,FF,24,10,BE
98 DATA 37,8C,31,3F,10,8C,00,00
99 DATA 26,F8,4F,B7,FF,24,5A,C1
100 DATA 00,26,CF,86,EF,10,8E,06
101 DATA 00,A7,A2,10,8C,04,00,26
102 DATA F8,10,8E,04,C9,86,19,A7
103 DATA A0,86,0F,A7,A0,86,15,A7
104 DATA A0,86,80,A7,A0,86,03,A7
105 DATA A0,86,12,A7,A0,86,01,A7
106 DATA A0,86,13,A7,A0,86,08,A7
107 DATA A0,86,05,A7,A0,86,04,A7
108 DATA 20,16,01,2B,86,14,16,FF
109 DATA 45,86,00,16,FF,40,34,12
110 DATA 8E,04,00,86,60,A7,80,8C
111 DATA 06,00,26,F9,35,12,10,8E
112 DATA 04,C9,86,59,A7,A0,86,4F
113 DATA A7,A0,86,55,A7,A0,86,60
114 DATA A7,A0,86,4C,A7,A0,86,41
115 DATA A7,A0,86,4E,A7,A0,86,44
116 DATA A7,A0,86,45,A7,A0,86,44
117 DATA A7,A0,86,61,A7,20,31,A8
118 DATA 36,86,46,A7,A0,86,55,A7
119 DATA A0,86,45,A7,A0,86,4C,A7
120 DATA A0,86,60,A7,A0,86,4C,A7
121 DATA A0,86,45,A7,A0,86,46,A7
122 DATA A0,86,54,A7,A0,86,7D,A7
123 DATA A0,31,A8,16,86,42,A7,A0
124 DATA 86,4F,A7,A0,86,4D,A7,A0
125 DATA 86,42,A7,A0,86,53,A7,A0
126 DATA 86,60,A7,A0,A7,A0,A7,A0
127 DATA A7,A0,86,7D,A7,20,10,8E
128 DATA 05,14,86,08,B7,37,4D,F6
129 DATA 35,52,4F,7F,37,4E,78,37
130 DATA 4E,58,49,81,0A,25,05,80
131 DATA 0A,7C,37,4E,7A,37,4D,26
132 DATA ED,8B,70,A7,20,B6,37,4E
133 DATA 8B,70,A7,3F,86,08,B7,37
134 DATA 4D,F6,35,56,4F,7F,37,4E
135 DATA 78,37,4E,58,49,81,0A,25
136 DATA 05,80,0A,7C,37,4E,7A,37
137 DATA 4D,26,ED,8B,70,A7,A8,20
138 DATA B6,37,4E,8B,70,A7,A8,1F
139 DATA 10,8E,98,58,EC,20,84,00
140 DATA C4,1F,1F,01,86,40,B7,FF
141 DATA 24,E6,20,5A,C1,00,26,FB
142 DATA 86,00,B7,FF,24,E6,20,5A
143 DATA C1,00,26,FB,30,1F,8C,00
144 DATA 00,26,E1,31,21,10,8C,98
145 DATA BC,2D,D1,20,02,12,12,10
146 DATA 8E,05,C8,86,41,A7,A0,86
147 DATA 4E,A7,A0,86,4F,A7,A0,86
148 DATA 54,A7,A0,86,48,A7,A0,86
149 DATA 45,A7,A0,86,52,A7,A0,86
150 DATA 60,A7,A0,86,47,A7,A0,86
151 DATA 41,A7,A0,86,4D,A7,A0,86
152 DATA 45,A7,A0,86,60,07,0A,86
153 DATA 7F,A7,A0,39
500 A=&H32C8
510 READ A$:POKE A,VAL("&H"+A$)
    :A=A+1
520 IF A<&H378C THEN 510
530 DEL-530
1000 PMODE1,1:PCLS
1010 SCREEN 1,0
1020 EXEC 13000
1030 SCREEN 0
1040 A$=INKEY$:IF A$=""THEN 1040
1050 IF A$="Y"THEN 1000
1060 END
```



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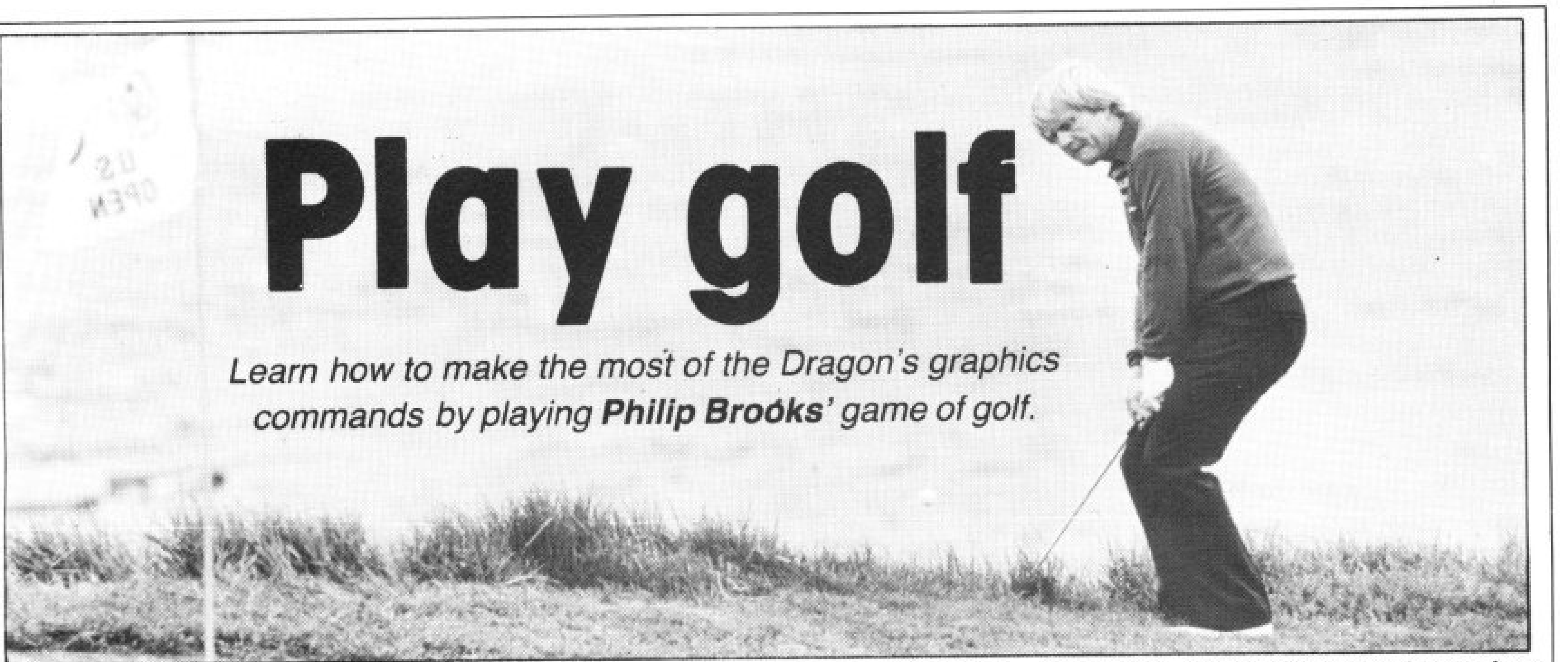
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The program begins by requesting details of the number of players taking part, and whether they wish to play the first nine, the second nine or all 18 holes. It then calls for the first player, and displays details of the hole to be played, including its length. The display then changes to a high-resolution map of the fairway, bounded by the rough (the red area). Lakes and streams are drawn in blue, bunkers are solid yellow areas, trees are yellow with red trunks (!), and the green is a hollow yellow circle with somewhere in it a flag. The position of the flag changes each time the game is played. The ball is shown as a yellow spot, and somewhere near the ball is a figure, coloured differently for each player.

The figure may be moved around the display, passing in front of the hazards, by means of the joystick control. Incidentally, despite what it says in the Dragon handbook, my machine interprets JOYSTK(0) and JOYSTK(1) as referring to the *right* joystick. When the figure is near the ball and is stationary it produces a club and 'addresses' the ball. The club will flash alternately blue and yellow, so that it can be seen against any background. The position of the figure can then be adjusted until the club just covers half of the ball, and the shaft of the club is at a right angle to the direction the ball is to go in, remembering that the club is always swung anti-clockwise to strike the ball.

The backswing is begun by pressing the joystick firing button. The figure then 'winds up' one notch at a time until the button is released, or until it reaches the full swing of twenty 'notches'. It then swings and strikes the ball. A full strength swing from the fairway normally travels about 200 yards, plus or minus anything up to 40 yards, though just occasionally a shot falls considerably shorter. It is important to remember that the fairway maps are not all drawn to the same scale, and the hole length displayed at the start of each turn gives an indication of how far across the screen a shot is likely to go. A shortened backswing produces a proportionally shorter shot. If the ball is not correctly addressed then a hook or slice shot may result, the ball travelling off line and with reduced carry. If the club head does not contact the ball then an 'air shot' results and the ball won't move.

In flight the ball passes over lakes and bunkers, and through the tops of trees. Over yellow background areas it changes colour so that it may be seen. If it enters the rough it stops immediately, and must be played directly back on to the fairway. If it strikes the trunk of a tree in its flight then it may bounce off in almost any direction, or continue its flight.

If, at the end of its flight, the ball is over water it disappears in a circle of ripples. After the figure has shown his displeasure the ball reappears on the bank on the side from which it entered, and the player's score is increased by one penalty stroke. If the ball lands in the top of the tree it drops vertically for a short distance until it is clear. When the ball finally comes to rest if it is in or close to a yellow area of the map it changes colour to blue. The figure is then repositioned to be close to the ball for the next shot. This procedure is omitted if the ball is already close. A shot from the rough is subject to considerable variation in its distance of travel. Shots from a bunker are also unpredictable to a certain extent, and may, on occasions, not move at all.

On the green

Eventually, the ball lands on the green. The display then changes to show a circular green, the hole, the figure and the ball. The ball can now be putted into the hole. It is possible to hole out directly from off the green, but I have never yet managed it. There are no random factors in putting, all greens are to the same scale and all putts are predictable (eat your heart out, Jack Nicklaus). Slice and hook shots are still possible, however, and if the ball is struck too firmly it will overrun the hole. If the ball is played off the putting surface then the display reverts to the fairway map and the ball must be chipped back on to the green.

When the ball is finally holed the player's score for the hole is displayed, and, if more than one hole is completed, his running score. The next player is then called, and the fairway map reappears. After each player has completed the hole the entire procedure is repeated for the next hole, and so on until the end of the game, when a full list of total scores is displayed.

A complete listing of the program is printed with this article. It loads in about 12K of memory, and when running leaves about 1.5K free. By deleting REMs and spaces it should be possible to create enough room for additional routines. Some ideas that come to mind are a handicapping system or a dance of joy and a fanfare for a hole in one!

The rather complex routine by which the figure is moved over a varying background without flicker makes full use of the Dragon's graphics commands. Both the high-resolution memory areas available in MODE 3 are employed, with the picture stored in one being displayed while the other is modified. For the purposes of the following, I shall refer to the memory area called by PMODE 3,1 as area 1, and that called by PMODE 3,5 as area 2.

After initialisation and introduction routines, control passes to the 'player count' loop starting at 4000. A message is written to the text screen, giving details of the next hole and player. While this is displayed subroutine 6500 is called. This draws the figure in the player's colours and stores it in arrays BD, WL and SL (body, walking leg and standing leg). Lines 4110 to 4250 now draw the fairway map in area 1. Line 4260 calls subroutine 100, which copies area 1 into area 2, so that both areas contain the fairway map minus the figure. Control then passes to line 1000.

Line 1000 switches the display to high-resolution area 1, which contains the fairway map. Before the figure is PUT into position, line 1020 stores the details of its background in arrays B1, B2 and B3. The figure, made up of BD and two copies of SL, is positioned. Lines 1010, 1070 ▶



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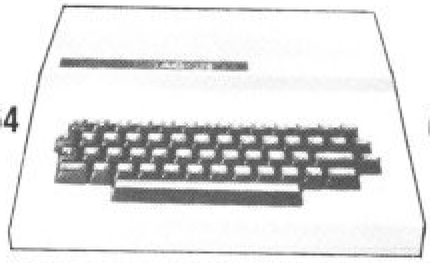
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◀ and 1080 are relevant if the fairway has been drawn as a result of the ball leaving the putting green. Lines 1100-1230 sample the joystick and process the values returned into acceptable incremental values for the figure position co-ordinates. Among the test in lines 1240-1260, line 1250 tests that the joystick is not centred, ie that the figure must move.

If the joystick is not centred, subroutine 1300 is called. While area 1 is still displayed, area 2 is modified as follows. The background arrays are PUT into their original positions, blanking out the figure. Line 1320 then stores the background to the new position in these arrays, and the figure is then PUT into its new position (lines 1330-1360). As an added refinement, one of its legs is raised as though walking. WK in line 1330 is used to ensure that alternate legs are raised each time the subroutine is called.

With the figure finally in its new position, but not yet displayed, line 1370 calls subroutine 110, which copies this revised picture almost instantaneously into area 1, the display. After a short pause the raised leg is lowered by PUTting SL into both leg positions (line 1390). The running co-ordinates of the figure position are then updated, and the program returns to the joystick sampling loop.

Line 1240 can provide an alternate subroutine to append to this loop. If the figure is close to the ball, and the joystick is centred, then subroutine 1500 is called.

Lines 1500-1550 are concerned with drawing the club in the right direction and with constant length, with the colour alternating at each pass. The club is drawn in line 1550 and after a short delay is blanked out by subroutine 110. This is preferable to a simple PRESET as it restores the club background to its original colour or colours, instead of leaving a line in whatever is the current background colour (usually green). Control then returns to the joystick loop.

Line 1260 provides the only exit from this loop. If the joystick fire button is pressed then control jumps to line 1600, and the backswing commences. The number crunching in lines 1600-1650 determines the angle the club is being presented at, with 0 being straight up. The backswing routine is similar to the club drawing routine, except that at each pass the values of CX and CY are recalculated from the angle AN, which increases by PI/12 each time. The previous club is blanked out by subroutine 110, and the new club is drawn, normally in yellow unless the club head coincides with a yellow area, when it is drawn blue.

Backswing

The 'shot distance' counter SD and the swing counter SW are both incremented, after which lines 1800 and 1810 check for the end of the backswing. At the end of the backswing the distance between the shaft end and the ball is checked. If this is greater or less than the length of the club the ball angle AB and shot distance SD are modified to produce 'hook' or 'slice'. Shots from the fairway, rough or bunkers are further modified by lines 1890-1920. The swing routine is a repeat of the backswing, except that the magnitude of the steps is increased and their number decreased, although note the addition of a constant to the count to provide 'follow through'.

At the end of the swing line 2080 tests for an air shot. If one is found then the player's score is increased and control returns to the 'figure movement' routine, if not then the ball is blanked out and the loop at 3000 is entered. This moves the ball in steps across the screen, checking the background colour and if necessary adjusting the colour of the ball. When on the fairway map a check is also made in line 3070 that the ball is not in the rough or has hit a tree. On the green the check at 3090 is that the ball has not left the green.

When line 3070 detects that the ball is in a red area the program jumps to 3300. Lines 3300-3320 check for striking a tree. If no tree is struck then the ball is in the rough and control is passed to the 'figure movement' routine. If a tree is struck, and it is the first time this has happened this shot, then the ball angle AB and shot distance SD are altered randomly, and the program loops back to 3000. The ball angle is modified in such a way that the ball can never rebound in the direction of the figure. Having the ball come to rest in the figure's midriff could be disastrous!

When the ball finally comes to rest several checks are made. These are all documented within the listing, and should be self explanatory. With the ball successfully in the hole the player's score and running score are displayed before the next player is called.

The program run begins with the by now familiar POKE 65495,0 to increase running speed. This has the effect of tying up the input/output circuitry, and programs can be neither loaded or saved until it is reset, either by the reset button or by POKE 65494,0. If you break out of the program before the end don't forget to reset before trying to load another program. It is probably advisable to replace line 6000 with a REM until loading and debugging is completed. It is very easy to save an amended program on tape, then discover later that you have overlooked the reset and recorded a load of garbage over your only copy! I speak from bitter experience.

If the prospect of all this keyboard bashing puts you off, I can supply the program on tape for £3. If you have any comments, or queries, I shall be pleased to have them. My address is: 104 Bargates, Leominster, Herefordshire HR6 8QT. ■

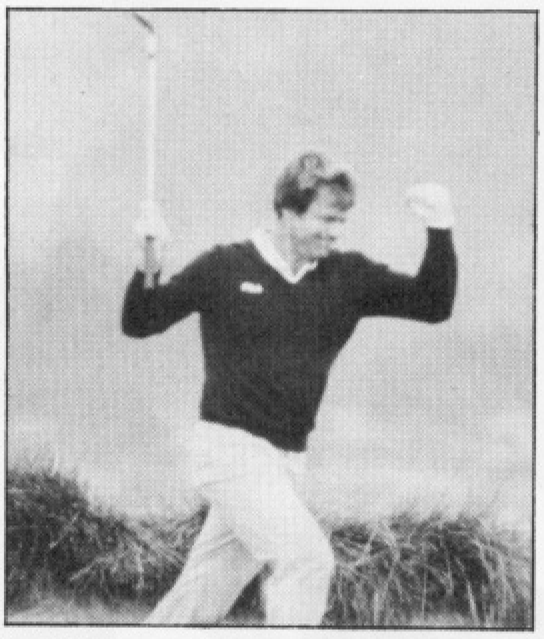
```
10 REM ***golf***
20 REM ***COPYRIGHT P.P.BROOKS***
30 GOTO 6000
100 FOR N=1 TO 4: PCOPY N TO N+4: NEXT N: RETURN
110 FOR N=1 TO 4: PCOPY N+4 TO N: NEXT N: RETURN
999 REM ***place figure***
1000 PMODE 3,1: SCREEN 1,0
1010 IF BF<>3 AND BG<>3 THEN GOSUB 7500
1020 GET (MX,MY)-(MX+9,MY-18),B1,G: GET (MX,MY+1)-(MX+2,MY+8),B2
,G: GET (MX+7,MY+1)-(MX+9,MY+8),B3,G
1030 PMODE 3,1
1040 PUT(MX,MY)-(MX+9,MY-18),BD,PSET
1050 PUT (MX,MY+1)-(MX+2,MY+8),SL,PSET
1060 PUT (MX+7,MY+1)-(MX+9,MY+8),SL,PSET
1070 IF BF=3 OR BG=3 THEN GOSUB 100: GOSUB 5000: GOSUB 100
1080 IF TF=1 THEN 3000
1090 IF SQR((BX-GX)^2+(BY-GY)^2)<GR THEN 4500: REM ***on green**
*
1100 SX=MX+4: SY=MY-3: CX=MX-2: CY=MY-10
1110 XI=0: YI=0
1120 XI=FIX((JOYSTK(0)-32)/6)
1130 YI=FIX((JOYSTK(1)-32)/6)
1140 IF ABS(XI)>4 THEN XI=2*XI
1150 IF ABS(YI)>4 THEN YI=2*YI
1199 REM ***limit movement***
1200 IF MX+XI<14 THEN XI=14-MX
1210 IF MX+XI>235 THEN XI=235-MX
1220 IF MY+YI<25 THEN YI=25-MY
1230 IF MY+YI>180 THEN YI=180-MY
1240 IF XI=0 AND YI=0 AND SQR((BX-(MX+4))^2+(BY-(MY-4))^2)<21 TH
EN GOSUB 1500:REM***draw club***
1250 IF XI<>0 OR YI<>0 THEN GOSUB 1300
1260 PK=PEEK(65280): IF PK=126 OR PK=254 THEN 1600:REM***start b
ackswing***
1270 GOTO 1120: REM***sample joystick again***
1299 REM ***draw walker***
1300 PMODE 3,5
1310 PUT(MX,MY)-(MX+9,MY-18),B1,PSET: PUT(MX,MY+1)-(MX+2,MY+8),B
2,PSET: PUT(MX+7,MY+1)-(MX+9,MY+8),B3,PSET
1320 GET (MX+XI,MY+YI)-(MX+XI+9,MY+YI-18),B1,G: GET (MX+XI,MY+YI
+1)-(MX+XI+2,MY+YI+8),B2,G: GET(MX+XI+7,MY+YI+1)-(MX+XI+9,MY+YI+
8),B3,G
```

```
1330 IF WK=1 THEN WK=0 ELSE WK=1
1340 PUT (MX+XI,MY+YI)-(MX+XI+9,MY+YI-18),BD,PSET
1350 IF WK=0 THEN PUT (MX+XI,MY+YI+1)-(MX+XI+2,MY+YI+8),SL,PSET
ELSE PUT (MX+XI,MY+YI+1)-(MX+XI+2,MY+YI+5),WL,PSET
1360 IF WK=0 THEN PUT (MX+XI+7,MY+YI+1)-(MX+XI+9,MY+YI+5),WL,PSE
T ELSE PUT (MX+XI+7,MY+YI+1)-(MX+XI+9,MY+YI+8),SL,PSET
1370 GOSUB 110
1380 FOR TI=1 TO 10: NEXT TI
1390 PMODE 3,1:PUT (MX+XI,MY+YI+1)-(MX+XI+2,MY+YI+8),SL,PSET: PU
T (MX+XI+7,MY+YI+1)-(MX+XI+9,MY+YI+8),SL,PSET
1400 MX=MX+XI: MY=MY+YI
1410 SOUND 36,1
1420 RETURN
1499 REM ***address ball***
1500 SX=MX+4: SY=MY-4: CC=INT(SQR((BX-SX)^2+(BY-SY)^2)): GOSUB 1
00
1510 IF CC<3 THEN CX=SX: CY=SY-17: GOTO 1530
1520 CX=SX+((17*(BX-SX))/CC): CY=SY+((17*(BY-SY))/CC)
1530 IF  CF=0 THEN COLOR 3,1: CF=1: GOTO 1550
1540 IF CF=1 THEN COLOR 2,1: CF=0
1550 LINE (SX,SY)-(CX,CY),PSET
1560 FOR TI=1 TO 200: NEXT TI
1570 GOSUB 110
1580 RETURN
1599 REM ***determine angle***
1600 IF CX>SX AND CY<=SY THEN AN=PI/2-ATN((SY-CY)/(CX-SX))
1610 IF CX>SX AND CY>SY THEN AN=PI/2+ATN((CY-SY)/(CX-SX))
1620 IF CX<SX AND CY>=SY THEN AN=3*PI/2-ATN((CY-SY)/(SX-CX))
1630 IF CX<SX AND CY<SY THEN AN=3*PI/2+ATN((SY-CY)/(SX-CX))
1640 IF CX=SX AND CY<SY THEN AN=0
1650 IF CX=SX AND CY>SY THEN AN=PI
1699 REM ***backswing***
1700 SD=0: AB=AN: SW=0: GOSUB 100
1710 SX=MX+4: SY=MY-4
1720 PMODE 3,1
1730 AN=AN+PI/12
1740 CX=SX+17*SIN(AN): CY=SY-17*COS(AN)
1750 GOSUB 110
1760 IF PPOINT(CX,CY)=2 THEN COLOR 3,1 ELSE COLOR 2,1
1770 LINE (SX,SY)-(CX,CY),PSET
1780 SD=SD+5: SW=SW+1
1790 SOUND 80,1
```

```
1800 IF SW>19 THEN 1820
1810 PK=PEEK(65280): IF PK=126 OR PK=254 THEN 1730
1820 SQ=INT(SQR((BX-SX)^2+(BY-SY)^2))
1830 SG=INT(SQR((BX-SX)^2+(BY+1-SY)^2))
1840 IF CY<=SY AND SQ<17 THEN AB=AB-PI/10: SD=SD*0.8
1850 IF CY>SY AND SG<17 THEN AB=AB-PI/10: SD=SD*0.8
1860 IF CY<=SY AND SQ>18 THEN AB=AB+PI/10: SD=SD*0.8
1870 IF CY>SY AND SG>18 THEN AB=AB+PI/10: SD=SD*0.8
1880 IF GF=1 THEN 2000
1890 SD=SD*PF*(0.8+0.4*RND(0))
1900 IF RND(0)<0.1 THEN SD=0.8*SD
1910 IF BF=4 OR BG=4 THEN SD=SD*(0.2+0.6*RND(0))
1920 IF SF=1 THEN SD=SD*(0.4+0.4*RND(0))
1999 REM ***swing***
2000 FOR CT=SW+3 TO 0 STEP-3
2010 AN=AN-PI/4
2020 CX=SX+17*SIN(AN): CY=SY-17*COS(AN)
2030 GOSUB 110
2040 IF PPOINT(CX,CY)=2 THEN COLOR 3,1 ELSE COLOR 2,1
2050 LINE (SX,SY)-(CX,CY),PSET
2060 SOUND 150,1
2070 NEXT CT
2080 IF SQ>20 OR SG>20 OR SQ<15 OR SG<15 THEN SC=SC+1: GOSUB 110
: GOTO 1100
2090  PMODE 3,5: PSET (BX,BY,BF)
2100 PSET(BX,BY+1,BG)
2110  PMODE 3,1: GOSUB 110
2120 SC=SC+1
2130 IF SF=1 AND RND(0)<0.1 THEN GOTO 1100
2999 REM ***move ball***
3000 FOR CT=1 TO SD STEP 3
3010 PSET(BX,BY,BF)
3020 PSET(BX,BY+1,BG)
3030 BX=BX-3*COS(AB): BY=BY-3*SIN(AB)
3040 BF=PPOINT(BX,BY): IF BF=2 THEN PSET(BX,BY,3) ELSE PSET(BX,B
Y,2)
3050 BG=PPOINT(BX,BY+1): IF BG=2 THEN PSET(BX,BY+1,3) ELSE PSET(
BX,BY+1,2)
3060 IF GF=1 THEN 3090: REM ***skip if on green***
3070 IF BF=4 OR BG=4 THEN 3260: REM***check for rough or tree***
```

Continued on page 33

```
3080 GOTO 3110
3090 IF BF=4 AND BG=4 THEN 4700: REM***return to fairway***
3100 IF BF=3 AND BG=3 AND CT>SD-10 THEN 8000: REM ***ball holed*
**
3110 NEXT CT: SF=0: TF=0
3120 REM ***ball stopped, check position***
3130 IF BX=HH AND (BY=HV OR BY+1=HV) THEN 8000: REM***ball holed
 from off green***
3140 GOSUB 7520: REM ***check if near yellow area***
3150 UH=PPOINT(BX,BY): LH=PPOINT(BX,BY+1): RB=0
3160 IF GF=1 THEN 3210: REM***skip if on green***
3170 IF SQR((BX-GX)^2+(BY-GY)^2)<GR THEN 4500: REM***check if on
 green***
3180 IF BF=3 OR BG=3 THEN GOSUB 5000: REM ***ball in water***
3190 IF BF=2 OR BG=2 THEN GOSUB 7000:REM***check if treed or bun
kered***
3200 IF TF=1 THEN 3000
3210 PMODE 3,5: PSET(BX,BY,UH): PSET(BX,BY+1,LH)
3220 PUT (MX,MY)-(MX+9,MY-18),B1,PSET: PUT (MX,MY+1)-(MX+2,MY+8)
,B2,PSET: PUT (MX+7,MY+1)-(MX+9,MY+8),B3,PSET
3230 IF SQR((BX-SX)^2+(BY-SY)^2)>30 THEN GOSUB 7100: GOSUB 110:R
EM***move figure to ball***
3240 GOTO 1020
3250 REM ***ball hit tree or rough?***
3260 FOR A=1 TO TC
3270 IF ABS(BX-(TK(A,1)+5))<=1 AND BY<=TK(A,2)+13 AND BY>=TK(A,2
)+4 THEN 3290
3280 NEXT A: GOTO 3150: REM***in rough***
3290 IF RB=1 THEN 3000: REM ***only one bounce per tree***
3300 REM ***compute bounce***
3310 PLAY "V31T10001GGFFEE": SD=15+(SD-CT)*0.7*RND(0): RB=1
3320 IF RND(0)<0.4 THEN AB=AB+PI*RND(0) ELSE AB=AB+.8*PI*(0.4-RN
D(0))
3330 GOTO 3000
3999 REM ***loop for each player***
4000 FOR PL=1 TO PN
4010 CLS: PRINT @ 75, "HOLE ";NH: PRINT @ 169, HL;" YARDS": PRIN
T @ 236, "PAR ";PR: PRINT @ 394, "PLAYER ";PL
4020 IF HC>1 THEN PRINT @ 454,"SCORE SO FAR=";SC(PL)
4030 GOSUB 6500
4099 REM ***draw fairway***
4100 MX=MH: MY=MV: BX=BH: BY=BV: GF=0: SC=0
4110 PMODE 3,1: PCLS
4120 DRAW "BM25,100C4"+FW$
4130 PAINT (3,3),4,4
4140 DRAW LK$
4150 PAINT (LX,LY),3,3
4160 FOR A=1 TO BC
4170 CIRCLE (BK(A,1),BK(A,2)),BK(A,3),2
4180 PAINT (BK(A,1),BK(A,2)),2,2
4190 NEXT A
4200 FOR A=1 TO TC: PUT(TK(A,1),TK(A,2))-(TK(A,1)+10,TK(A,2)+12)
,TR,PSET: NEXT A
4210 BF=PPOINT(BX,BY): IF BF=2 THEN PSET(BX,BY,3) ELSE PSET (BX,
BY,2)
4220 BG=PPOINT(BX,BY+1): IF BG=2 THEN PSET(BX,BY+1,3) ELSE PSET(
BX,BY+1,2)
4230 CIRCLE (GX,GY),GR,2
4240 HH=GX+HX: HV=GY+HY
4250 DRAW "BM"+STR$(HH)+","+STR$(HV)+"C2U6R3G2L1"
4260 GOSUB 100
4270 GOTO 1000: REM ***move figure***
4499 REM ***draw green***
4500 GF=1: HH=126+6*HX: HV=96+6*HY: BX=126-6*(GX-BX): BY=96-6*(G
Y-BY): BF=1: BG=1
4510 GOSUB 7100
4520 PMODE 3,5: PCLS: CIRCLE(126,96),6*GR,4
4530 PAINT(3,3),4,4
4540 CIRCLE (HH,HV),4,3
4550 PAINT (HH,HV),3,3
4560 PSET(BX,BY,2)
4570 PSET (BX,BY+1,2)
4580 GOSUB 110
4590 GOTO 1010
4699 REM ***return to fairway***
4700 BX=GX+((BX-126)/6): BY=GY+((BY-96)/6): GF=0: GOSUB 7100
4710 BX=BX-((SD-CT)/6)*COS(AB): BY=BY-((SD-CT)/6)*SIN(AB): PMODE
 3,5: SCREEN 1,0
4720 GOTO 4110
4999 REM ***ball in water***
5000 PMODE 3,1: PSET (BX,BY,3): PSET (BX,BY+1,3): PMODE 3,5: PSE
T(BX,BY,3): PSET(BX,BY+1,3): PMODE 3,1
5010 PLAY "T8O02L1CBAGFEDDD"
5020 SC=SC+1
5030 CIRCLE (BX,BY),3,2
5040 CIRCLE (BX,BY),6,2
5050 CIRCLE (BX,BY),3,3
5060 CIRCLE (BX,BY),10,2
5070 CIRCLE (BX,BY),6,3
5080 CIRCLE (BX,BY),10,3
5090 GOSUB 110
5100 PMODE 3,5: PUT (MX,MY)-(MX+9,MY-18),B1,PSET: PUT (MX,MY+1)-
(MX+2,MY+8),B2,PSET: PUT (MX+7,MY+1)-(MX+9,MY+8),B3,PSET
5110 PUT (MX,MY-4)-(MX+9,MY-22),BD,PSET: PUT (MX,MY-3)-(MX+2,MY+
1),WL,PSET: PUT (MX+7,MY-3)-(MX+9,MY+1),WL,PSET
5120 FOR JC=1 TO 4
5130 PMODE 3,5:SCREEN 1,0: FOR TI=1 TO 50: NEXT TI
5140 PMODE 3,1: SCREEN 1,0: FOR TI=1 TO 50: NEXT TI
5150 PLAY "T5O01L4GGGEEECCC"
5160 NEXT JC
5170 GOSUB 100
5180 DC=0
5190 BX=BX+2*COS(AB): BY=BY+2*SIN(AB)
5200 GOSUB 110
5210 IF PPOINT(BX,BY)=3 OR PPOINT(BX,B+1)=3 THEN 5190
5220 BF=PPOINT(BX,BY): PSET(BX,BY,2): BG=PPOINT(BX,BY+1): PSET (
BX,BY+1,2): DC=DC+1: IF DC<3 THEN 5190
5230 RETURN
5999 REM ***initialisation***
6000 POKE 65495,0
6010 CLS
6020 PCLEAR 8
6030 PI=3.1415926
6040 FOR T=1 TO PEEK(275): R=RND(0): NEXT T
6050 DIM BD(9,18),SL(2,7),WL(2,4),B1(9,18),B2(2,7),B3(2,7),SC(4)
,TK(5,2)
6099 REM ***draw tree***
6100 PMODE 3,1: PCLS: CIRCLE(100,50),5,2
6110 PAINT (100,50),2,2
6120 COLOR 4,1: LINE (100,50)-(100,57),PSET
6130 DIM TR(13,11): GET (96,45)-(106,57),TR,G
6199 REM ***setting up***
6200 CLS: PRINT @ 4,"WELCOME TO DRAGON'S DEN"
6210 PRINT @ 42,"COUNTRY CLUB"
6220 PRINT @ 160, "HOW MANY PLAYERS (1 TO 4) ARE   TAKING PART?"
,,"(PLEASE TYPE IN THE NUMBER,     THEN PRESS 'ENTER')"
6230 LINE INPUT R$: PN=VAL(R$)
6240 IF PN<1 OR PN>4 THEN PRINT @ 288, "I CAN'T HANDLE ";PN,"PLE
ASE CHOOSE BETWEEN 1 & 4": GOTO 6230
6250 CLS: PRINT @ 64, "YOU MAY PLAY ANY OF THESE:-"
6260 PRINT "1     THE FIRST 9 HOLES","2     THE LAST 9 HOLES","3
     ALL 18 HOLES"
6270 PRINT: PRINT @ 256, "PLEASE ENTER ONE OPTION (1 TO 3)"
6280 LINE INPUT R$: OP=VAL(R$)
```



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6290 IF OP<1 OR OP>3 THEN CLS: PRINT @ 64, "TRY AGAIN": GOTO 626
0
6300 IF OP=1 THEN HN=9
6310 IF OP=2 THEN HN=9: GOSUB 8500
6320 IF OP=3 THEN HN=18
6399 REM ***start hole count***
6400 CLS
6410 FOR HC=1 TO HN
6420 READ NH,FW$,LK$,LX,LY,GX,GY,GR,PF,PR,HL,BC,BH,BV,MH,MV,TC
6430 FOR CC=1 TO BC: READ BK(CC,1),BK(CC,2),BK(CC,3): NEXT CC
6440 FOR CC=1 TO TC: READ TK(CC,1),TK(CC,2): NEXT CC
6450 HX=INT(GR*2*(0.5-RND(0)))-2: HY=INT(GR*2*(0.5-RND(0)))-2
6460 IF SQR(HX^2+HY^2)>GR-2 THEN 6450
6470 GOTO 4000
6499 REM ***draw figure***
6500 PMODE 3,1: PCLS
6510 IF PL=1 OR PL=3 THEN PC=3 ELSE PC=2
6520 DRAW "BM180,90C"+STR$(PC)+"U8E3H2U3E2R3F2D3G2F3D8L7"
6530 IF PL=3 THEN PAINT(182,88),1,PC ELSE PAINT (182,88),(PL+1),
PC
6540 GET(180,90)-(189,72),BD,G
6550 DRAW "BM180,91C2D7R2U7L2": PSET (180,98,3): PSET (181,98,3)
6560 DRAW "BM189,91C2D4L2U4R2": PSET (189,95,3): PSET (190,95,3)
6570 GET (180,91)-(183,98),SL,G
6580 GET (187,91)-(189,95),WL,G
6590 PCLS
6600 RETURN
6999 REM ***check if treed or bunkered***
7000 FOR AA=1 TO BC
7010 IF SQR((BX-BK(AA,1))^2+((BY+1)-BK(AA,2))^2)<=BK(AA,3) THEN
SF=1
7020 IF SQR((BX-BK(AA,1))^2+(BY-BK(AA,2))^2)<=BK(AA,3) THEN SF=1
:REM***bunkered***
7030 IF SF=1 THEN RETURN
7040 NEXT AA
7050 FOR A=1 TO TC
7060 IF SQR((BX-(TK(A,1)+5))^2+(BY-(TK(A,2)+5))^2)<=5 THEN AB=(3
*PI)/2: SD=5: TF=1: RETURN:REM***treed***
7070 NEXT A
7080 RETURN
7099 REM ***move figure to ball***
7100 IF BY<=HV THEN MX=BX+5 ELSE MX=BX-15
7110 IF BX<=HH THEN MY=BY-17 ELSE MY=BY+25
7120 IF MY<40 THEN MY=40: MX=BX-13
7130 IF MY>170 THEN MY=170: MX=BX-13
7140 IF MX<10 THEN MX=10
7150 IF MX>225 THEN MX=225
7160 RETURN
7499 REM ***check ball position***
7500 IF BF=2 OR BG=2 THEN GOSUB 7000
7510 IF BF=4 AND BG=4 THEN GOSUB 7610
7520 IF PPOINT(BX-2,BY)=2 OR PPOINT(BX+2,BY)=2 OR PPOINT(BX,BY-2
)=2 OR PPOINT(BX,BY+2)=2 OR PPOINT(BX-2,BY+1)=2 OR PPOINT(BX+2,B
Y+1)=2 THEN PSET(BX,BY,3): PSET(BX,BY+1,3)
7530 RETURN
7540 FOR A=1 TO TC
7550 IF ABS(BX-(TK(A,1)+5))<=1 AND BY<=TK(A,2)+13 AND BY>=TK(A,2
)+4 THEN 7570
7560 NEXT A: GOTO 7610
7570 AB=PI
7580 BX=BX-3*COS(AB): BY=BY-3*SIN(AB)
7590 BF=PPOINT(BX,BY): BGPPOINT(BX,BY+1)
7600 PSET(BX,BY,2): PSET(BX,BY+1,2): IF BF<>4 AND BG<>4 THEN RET
URN ELSE 7580
7610 PSET(BX,BY,BF): PSET (BX,BY+1,BG)
7620 AB=AB+PI
7630 BX=BX-3*COS(AB): BY=BY-3*SIN(AB)
7640 BF=PPOINT(BX,BY): BG=PPOINT(BX,BY+1)
7650 IF BF<>4 AND BG<>4 THEN 7670
7660 GOTO 7630
7670 AB=AB-PI: BX=BX-3*COS(AB): BY=BY-3*SIN(AB)
7680 BF=PPOINT(BX,BY): BG=PPOINT(BX,BY+1)
7690 PSET (BX,BY,2): PSET(BX,BY+1,2)
7700 GOSUB 7100: GOSUB 100: RETURN
7999 REM ***ball holed, display score***
8000 PLAY "T10003L2GGGCCCEEEEEEEE": PSET(BX,BY,3): PSET(BX,BY+1,3
): FOR TI=1 TO 300: NEXT TI: CLS: PRINT @ 43,"PLAYER ";PL: PRINT
 @ 132, "SCORE FOR HOLE ";NH;"=";SC
8010 SC(PL)=SC(PL)+SC: IF HC>1 THEN PRINT @ 355, "SCORE FOR ";HC
" HOLES=";SC(PL)
8020 FOR TI=1 TO 2000: NEXT TI
8030 NEXT PL
8040 NEXT HC
8050 CLS: PRINT @ 42, "END OF GAME": PRINT @ 75,HN;"HOLES"
8060 PRINT: PRINT
8070 FOR N=1 TO PN
8080 PRINT TAB(6);"PLAYER ";N; TAB(22); SC(N)
8090 NEXT N
8100 POKE 65494,0
8110 FOR TI=1 TO 10000: NEXT TI: END
8499 REM ***read first nine holes***
8500 FOR AA=1 TO 9
8510 READ NH,FW$,LK$,LX,LY,GX,GY,GR,PF,PR,HL,BC,BX,BY,MX,MY,TC
8520 FOR BB=1 TO BC
8530 READ BK(BB,1),BK(BB,2),BK(BB,3): NEXT BB
8540 FOR A=1 TO TC: READ TK(A,1),TK(A,2): NEXT A
8550 NEXT AA: RETURN
9009 REM ***data***
9010 DATA 1,"U10E40R50E20R50F40D30G30L70H20L70H10","BM175,30C3R1
0F40D30G10U35H45R5",180,32,180,80,13,0.75,4,389,3,35,90,32,65,2
9015 DATA 110,90,8,160,75,6,165,95,6,100,60,140,100
9020 DATA 2,"U70E10R50F50R40F50D50L90H30L40H40","BM125,100C3D10G
5D10F5R5E5R5U20H5L10",127,102,200,150,10,0.82,5,480,2,35,45,32,2
2,3
9025 DATA 88,70,8,127,90,6,100,55,200,120,170,110
9030 DATA 3,"D60R70E60R70U60L70G60L70","BM155,40C3D60R15U40E20L3
5",157,43,192,70,13,2.01,3,156,2,35,130,32,100,3
9035 DATA 208,50,8,210,72,6,120,80,200,85,190,45
9040 DATA 4,"U20E10R90F20R70F10D20G10L90H20L70H10","BM25,100C3U2
0E10R5F10D20G10L5H10",27,100,62,98,10,1.96,3,143,2,200,115,200,1
37,29045 DATA 66,76,6,85,93,7,100,75,75,75
9050 DATA 5,"U75R50F100R30F20D35LJ20H80","BM76,84C3R6E6U6R6D6G12
L6U6",78,86,70,65,12,0.94,4,339,1,200,155,195,180,4
9055 DATA 50,45,9,90,100,80,130,95,70,105,85
9060 DATA 6,"R50F15E90R25F20D55G80L100H20U60","BM100,130C3D10F10
R30U15H5L35",110,137,200,50,13,0.98,4,382,4,32,111,30,95,3
9065 DATA 100,120,8,130,90,6,180,60,5,183,34,9,130,100,190,70,17
5,42
9070 DATA 7,"D80R50E40R60E50U40L150G50","BM110,130C3H20E20R15D20
R20G20L15",110,120,50,150,13,0.7,5,517,1,205,60,207,85,5
9075 DATA 60,120,10,130,80,70,100,75,150,72,120,90,70
9080 DATA 8,"U60E20R20F20D50F20R20F20R60F15D10G15L100H10U20G40L1
0H20U60","BM85,90C3F20R20F20D40L10U40L20H90E5F55",85,92,180,150,
12,1.1,4,362,4,60,50,58,30,2
9085 DATA 55,140,10,160,143,6,160,162,6,199,150,6,120,135,80,125
9090 DATA 9,"U50R30E20R50F60R20F20D50G20L30H35U25H40G15L60","BM5
5,50C3E20R50F60R20F20D30H90L80",59,47,50,80,13,0.97,4,393,2,187,
164,178,150,2
9095 DATA 33,65,7,140,70,6,140,100,70,60
9100 DATA 10,"D80R30E20R30E20R30E20R30E20R15U50H20L65G50L30G20L3
0","BM155,55C3D10F10R15U20L25",172,57,200,55,13,1.82,3,194,3,35,
120,32,100,4
9105 DATA 180,85,6,210,75,7,225,50,8,120,100,180,100,180,40,100,
90
9110 DATA 11,"U40R130E50R20D70G70L20U50L90H20","BM140,60C3D10F5R
20U25G10L15",147,62,70,75,12,.96,4,306,3,210,20,212,40,3
9115 DATA 40,70,8,100,80,10,155,85,10,120,70,180,70,170,90
9120 DATA 12,"U50E30R100D40R70D70G40L60H70L30","BM120,100C3U5H10
U10R30F20D20L25H15",125,100,200,100,12,0.7,5,520,3,30,60,28,40,5
9125 DATA 130,120,10,75,65,10,170,85,10,120,45,180,100,100,120,2
00,65,210,110
9130 DATA 13,"U50E30R100F70D80L70U40H30L100","BM170,130C3U5H15L2
0U30R10D20R25U10E10R30D30G20L20",172,128,180,150,13,1,4,385,1,30
,80,28,60,2
9135 DATA 160,90,9,160,130,200,150
9140 DATA 14,"D90R50E50R50E50U50L50G50L50G50","BM125,140C3U10E5R
25D15L30",127,138,200,60,13,1.17,4,347,4,40,185,30,165,2
9145 DATA  105,105,10,170,70,10,215,70,7,130,120,7,120,100,180,7
5
9150 DATA 15,"U30R50F20E20R70F30G30L40H20G20L80U30","BM115,70C3D
35F5R5E5U10H5L5U20L5",117,72,190,100,13,1.93,3,160,2,35,100,32,8
0,2
9155 DATA 185,120,10,175,80,12,75,86,160,100
9160 DATA 16,"U60R100F100D30L50H50L100U20","BM124,40C3D40G40R6E4
0U40L6",126,42,200,150,13,0.98,4,350,2,35,100,32,70,1
9165 DATA 170,130,9,200,130,6,120,98
9170 DATA 17,"E30R50F20E60R30F10D90G30L170U60","BM125,90C3D10F10
D20R5U22E5U33G20",130,90,185,50,12,0.98,4,382,1,35,100,30,70,3
9175 DATA 180,75,8,120,115,195,70,150,65
9180 DATA 18,"U60R140F60D50G10L30H20L100H40","BM85,50C3D30F10R15
E20U10H15G5L25",90,55,200,140,12,0.8,5,472,2,32,50,30,35,4
9185 DATA 172,135,10,195,110,10,70,100,83,101,210,120,140,112
```

Finding out about Forth

***Keith and Steve Brain** introduce the intricacies of Forth.*

WITHOUT DOUBT FORTH must be the 'in' programming language for 1983 as the pundits tell us that it's the best thing since sliced bread, and that no computer should be without it. Basic has been dismissed as that tired old lady of micro languages, while the virtues of the speed, structure and portability of Forth have been extolled. And it seems that the ability to make intelligible noises on the subject of Forth is now an essential part of the repertoire of every computer bore.

But does Forth really reach the parts other languages cannot reach, or is this just another example of the king's new clothes, that only a fool cannot see? In this article we will try to separate the myth from the reality and start off by looking at how Forth operates.

The language is unusual in that it was developed originally by just one man, Charles H Moore, as his answer to the deficiencies of Fortran and Algol. If you have tried to work out a logical derivation for the name Forth, tax your brain no more, as it was really an accident. He wanted to call it Fourth, as he thought of it as a fourth generation language, but the machine he was using only allowed five letter names so he just left the 'U' out!

It was initially devised as a control language for astronomy and there are two primary dialects Forth-79 and fig-Forth (fig stands for Forth-Interest-Group), which differ in a number of respects. The version most commonly implemented on micros is fig-Forth.

The official standards for both these Forth versions lay down certain minimum requirements, so that programs written in either dialect can easily be converted from one machine to another, provided that it uses the same dialect.

Benefits

Individual commercial Forth packages differ in the ways that they use the available memory and in the extra facilities which have already been included for the benefit of the user, but we'll come back to the icing once we've looked at the main part of the Forth cake.

One of the major advantages of Forth is that programs are usually executed much faster than their Basic equivalents, but of course there has to be some penalty for this increase in speed. Forth is a more difficult language to master than Basic and it is not altogether user-friendly.

As the whole fundamental concept of programming in Forth is so different to programming in Basic, you really need to throw your ideas out of the window and start again. The experts extol the virtues of the structured nature of Forth, which they insist helps you write much better programs, but that only holds if you don't get lost or give up on the way. In the short term it really means that you must sort out your ideas very thoroughly and that your programs need to be more carefully planned.

As a Basic-user you will think of programs being organised as statements placed on lines, which are executed in order (except where loops, GOTO or GOSUB are encountered) but Forth is not organised like that at all. It is built up from Forth words which are really just labels for different machine code subroutines which carry out particular single tasks. Every Forth system has a series of these words built in. For example the word [+] will cause two numbers to be added together.

If you want to do something more complicated than adding two numbers you simply write several of the available words consecutively to make a complete program. All the words which are available to the user are contained in what is appropriately known as the dictionary in memory. When you first buy a Forth package this will only contain words pre-defined by the software supplier.

To be able to program in Forth you must understand how a stack works, because most Forth operations involve the stack. Although people often find it difficult to grasp the idea of the stack there is really nothing complicated about it — it is simply an area of memory where numbers are temporarily stored. The stack operates on the last in first out principle and it is often visualised as a pile of plates.

The most important thing to remember is that numbers are always added to the top, and that only the top number can be removed. (If your only experience of dealing with plates is stacking them vertically into your microprocessor-controlled dishwasher then try the alternative 'union rule on redundancy' analogy.)

Another major difference from Basic is that Forth operations use Reverse Polish Notation (RPN). If you want to add 2 and 4 on paper or in Basic you write: 2 + 4. Note that the operator (+) is placed between the operands (2 and 4). In RPN this is written with the operator last:

24 +

This may seem rather Irish to everyone drilled from the cradle to put the operator in the middle (unless they have battled with RPN on a Hewlett-Packard calculator). But it is very logical for a stack-based system, as you can hardly manipulate a number which is not already identified by being on the stack. In the example above the numbers 2 and 4 are pushed on to the stack and then the [+] tells the system to take the top two numbers from the stack, add these together and then put the result back on top of the stack.

A whole series of other arithmetic operators are also provided in Forth. For example [★] is used for multiplication, [MAX] leaves the higher of two numbers on the stack, and [MIN] leaves the lower of two numbers on the stack. It is sometimes difficult to think of certain Forth words as commands as they look more like punctuation. For example [.] prints out the top number on the stack.

In addition to allowing you to add numbers to the top of the stack and retrieve them, Forth also contains words which allow you to copy and change the order of numbers on stack. For example [DUP] will duplicate the top number on the stack, [OVER] will copy the second number on to the top of the stack, [DROP] will delete the top number on the stack, and [SWAP] will exchange the top two numbers on the stack.

If you combine these operations together you can soon get more powerful functions. Thus [DUP +] will double a number, [DUP ★] will square it, and [DUP ★ DUP ★] will quadruple it. Note that spaces between Forth words are absolutely essential, and that missing spaces are one of the main sources of program bugs.

Fetching

Moving numbers in and out of memory locations is accomplished by the fetch and store instructions. The word [@] fetches a number from a specified location in memory and leaves it on top of the stack. Thus [300 @] will put the number at memory location 300 on top of the stack. Of course you will not see this number unless you add a print instruction [300 @ .]. The opposite operation to fetch is store [!] which puts a number, which is first put on to the stack, into a specified memory location. Thus [600 300 !] will store the number 600 at memory location 300.

If you want to find out what is in a memory location without reading the contents on to the stack you can use [?]. Thus [300 ?] will now display the 600 we just stored there. An extension of this is DUMP which will display a specified number of memory locations starting from a defined point. These last two words are very useful when debugging.

There are many occasions when it is useful to be able to copy whole blocks of data from one part of memory to another (eg word and data processing) and this is done with MOVE and CMOVE, which require you to define a source address, a destination address, and the number of items to be moved. Thus [300 500 50 MOVE] will copy 50 numbers from locations 300 onward to 500 onward.

If you have followed the story so far you will perhaps have noticed that Forth looks like a lot of other high-level languages, or may seem even more complicated ▶

FOR THE DISBELIEVERS . . .

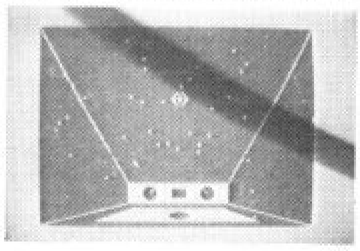
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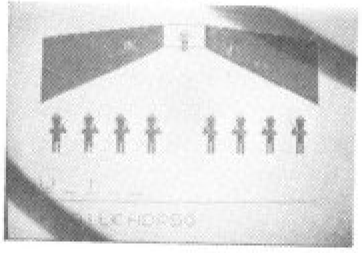
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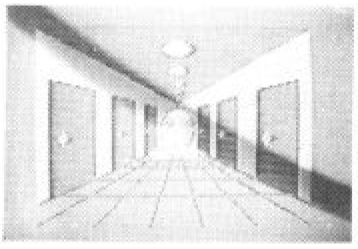
Execution

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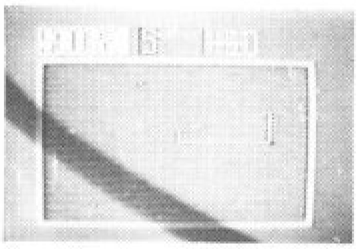
Wumpus Mansion

Incredible fun! Outwit the Wumpi (if you can . . .) and raid the mansion. Collect treasures, and Wumpus Blasters and escape through the maze of tunnels, but don't trigger the TIME BOMB. Different each time you play. Uses 29K!



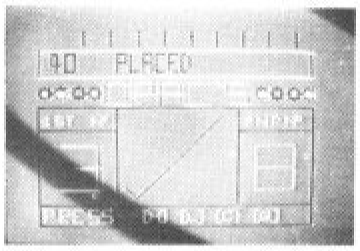
Wipeout

Challenging game of fast reaction that begins easy but gets progressively harder. 1-4 players, on-screen scoring good sound effects and 4-colour graphics. Be warned — this is not easy!



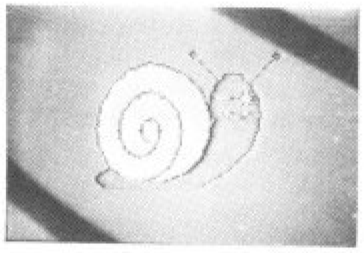
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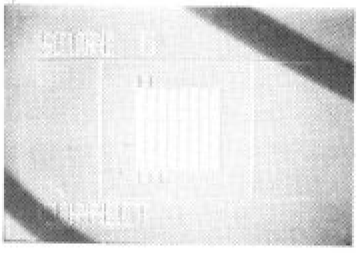
Snail Pace

The graphics are excellent — the excitement is almost unbearable. 1-8 'racing snails' whizz up the racecourse to the finishing line. Computer calculated odds and form that really works. A superb piece of complex programming ensures hours of entertainment. A massive 26K!



Atom Hunt

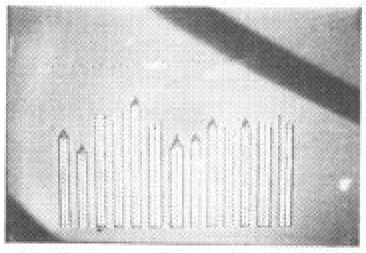
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◀ and unintelligible than most. But we have not yet described the main advantage of Forth which is the ability to define and compile your own words for new tasks which can then be added to the dictionary.

The only limitations on defining new Forth words are that they must be built up from existing Forth words (original or user-defined), and that you must have enough space in the dictionary to hold them. It is the great flexibility which this introduces that sets Forth apart from other languages.

In fact defining new words is one of the easiest operations in Forth. All you need to do is to place the name of the new word you want to define. and the sequence of existing words to be followed, between a colon and a semi-colon. For example [: SQUARE DUP * ;] defines a new word SQUARE. Once this definition has been compiled then every time you use [SQUARE] the sequence [DUP *] will be followed. Of course your new words can be much more complicated than that!

One of the main reasons Forth is faster than Basic is because Basic is an 'interpreted' language but Forth is 'compiled'. Of course the CPU can only actually work with machine code, and all high-level languages must translate your instructions into a suitable form which the CPU can understand.

To illustrate the fundamental difference between a compiled and an interpreted language think of writing a program to boil a kettle. First, the Basic version:

```
10 PUT KETTLE UNDER TAP
20 TAP ON
30 IF LEVEL<LIMIT THEN 30
40 TAP OFF
50 KETTLE ON
60 IF TEMP<100 THEN 60
70 KETTLE OFF
```

When RUN, the CPU goes to its own dictionary (the Basic interpreter) to find the meaning of PUT. If this is a valid command then it will jump to a corresponding machine-code subroutine in the ROM, which it will use to act on the variables KETTLE and TAP. It now finds ON and goes through the whole process of interpretation once again, before it can act on the variable TAP.

Next it finds IF and <, which it looks up to find that it must compare the variables LEVEL and LIMIT and branch according to which one is higher. The execution of the program therefore proceeds in fits and starts as each command is searched for in the interpreter and then acted on in turn. This process of interpretation is gone through *every* time the program is run.

In Forth, on the other hand, you can define a new word [BOIL-KETTLE] which contains all the instructions on how to boil a kettle, but nothing else. Initially you must define exactly how to boil the kettle but, once you have got all the instructions together, you can COMPILE them into a new word.

During this compilation process your instructions are converted into a new pseudo-machine code sequence which is stored in memory. This machine code routine contains the complete instructions on how to boil the kettle which are now

```
VLIST
RPT-OFF    RPT-ON    EDIT
WHERE    EDITOR    GOTOXY ~
COPY    FLUSH    ENDCASE
ENDOF    OF    CASE    CLS
2SWAP    2DUP    2DROP    LINE
TEXT    WHILE    ELSE    IF
REPEAT    AGAIN    END    UNTIL
+LOOP    LOOP    DO    THEN
ENDIF    BEGIN    BACK    NEXT
USER    VARIABLE    CONSTANT
TRIAD    INDEX    CSAVEM    HDR
P-OFF    P-ON    DUMP    DLEN
VLIST    LIST    FORGET    '
?    .    .R    D.    D.R    #S
#    SIGN    #>    <#    SPACES
;    :    -->    LOAD    MESSAGE
.LINE    (LINE)    BLOCK
BUFFER    R/W    HI    LO
EMPTY-BUFFERS    UPDATE
+BUF    PREV    USE    M/MOD
*/    */MOD    MOD    /    /MOD
*    M/    M*    MAX    MIN
DABS    ABS    D+-    +-    COLD
ABORT    QUIT    CR
?TERMINAL    <    DEFINITIONS
FORTH    VOCABULARY
IMMEDIATE    INTERPRET
?STACK    DLITERAL    LITERAL
[COMPILE]    CREATE    ID.
```

Excerpts from Teleforth's dictionary

followed at high speed (with no wait for interpretation), every time you call the word [BOIL-KETTLE].

Printing out all the words in the Forth dictionary is done by [VLIST]. To get rid of an existing word you [FORGET] it. But this must be used with great care as it also deletes every other word above the defined word in the dictionary (ie every word defined after the word you want to delete). It is possible to redefine existing words, but if you forget to [FORGET] the old versions before you compile the new ones your dictionary soon fills up!

Of course any new definitions you make will only be retained until you power-down, unless you save them on cassette or disk. Originally Forth was written to operate with disks and even the non-disk systems currently available for the Dragon operate using areas of RAM as simulated disks.

Rather than saving the compiled versions in the dictionary it is more useful to keep a copy of the source code (the complete definition) so that you can modify it, using an editor facility, at a later date. Forth organises source code on a series of numbered screens, but the details of these, and the editor commands, vary from one implementation to another. When you are satisfied with your source program you compile it into the dictionary using [LOAD]. Thus [2 LOAD] will compile the words on screen 2 and add them to the dictionary.

Basic equivalents

The Forth equivalent of the Basic FOR ... NEXT control structure is the [DO ... LOOP] which causes a given sequence of words to be executed a number of times. It increments the loop count by one with each execution, but [DD ... +LOOP] increments by a specified number (rather like STEP in Basic). An extension of the DO ... LOOP is [BEGIN ... UNTIL] which is really a DO ... LOOP of unspecified length which repeats until a flag on the stack becomes true.

Instead of the Basic IF ... THEN ... ELSE, we have the slightly scrambled [IF ... ELSE ... ENDIF] where only the words between IF and ELSE are executed if the flag is true, and only the words after ENDIF are executed if the flag is false.

The main variations between different Forth implementations are in the extra words which are predefined, and in the way the system is organised, so let's compare the rather different approaches of Dragonforth from Oasis Software and Teleforth from Microdeal.

Dragonforth seems to be aimed very much at the games end of the market as the main features are easy-use of hi-res graphics and the ability to access nearly all of the standard Basic commands in Forth. It is therefore something of a hybrid implementation which is particularly useful to the novice who can't face machine code but wants to use Forth to speed up hi-res graphics programs.

The demonstration program on the reverse of the cassette gives some hi-res examples, although we were surprised to find we could reproduce some of these almost as fast using Basic alone. Presumably the increase in speed was small because the calculations involved in these demo programs were very simple, and because the actual movements were executed at a similar speed in both Forth and Basic. But higher speed gains should be achieved as the complexity of the calculations increases.

Text is organised into blocks of 256 bytes — as eight lines of 32 characters on 20 screens (giving a total of 5K) to fit the Dragon display. A standard Forth line editor is included but the lack of a cursor is a very irritating omission. Basic statements are included by placing them in square brackets and these are also compiled. [GETKEY] is equivalent to INKEY$ and [JOYSTK n] reads the relevant joystick co-ordinates.

The user manual is nicely produced and makes some attempt to explain how Forth operates, but regrettably a lengthy addendum of errors is included. In addition we found out the hard way that there were still a number of errors which had escaped notice!

Teleforth is a modification of the Armadillo Colorforth for the Tandy Colour Computer and is rather more a Forth for the serious user. Text is organised into the more normal Forth pattern of 1024 byte blocks — as 16 lines of 64 characters on 10 screens (giving a total of 10K). Graphics are not supported directly but writing and modifying programs is much easier as there is a cursor and a full screen editor, in place of a cumbersome line editor. In addition to the usual fig-Forth words, output can be diverted to the printer with P-ON and P-OFF, a feature which is really an essential, and a cursor (key) repeat can be enabled (RPT-ON and RPT-OFF).

Teleforth also provides the double number (32 bits) extensions [2 DROP], [2 DUP] and [2 SWAP] as well as the useful additional control structures [CASE] — [ENDCASE] and [OF] — [ENDOF] (roughly equivalent to the Basic ON-GOTO).

We have not seen the final version of the manual (only the original Armadillo Colorforth version) as further modifications were still being made to the Dragon version. If Microdeal can maintain the standard set by the documentation for its Telewriter word-processor package then it should be first-class. ■

Getting to grips with Dragon input and output

***Ian Nicholson** guides you through the Dragon's input/output memory locations, among the most important to be found in the memory map.*

THE ADDITIONAL INFORMATION booklet supplied with the Dragon labels the memory between FF00 and FF5F rather uninformatively as 'input/output'. Initially the user might think there are 96 useful locations, but since each location occurs eight times there are only in fact 12 — and four of these are reserved for future I/O enhancement. So there are only eight effective locations in the I/O.

These eight locations control the keyboard, sound output, cassette relay, video and screen modes, joystick control, printer control and timer update. It is quite clear that they are probably the most important in the whole memory map, and a thorough understanding of how the I/O works is essential for anyone intent on mastering the 6809 machine language.

The I/O is divided into three sections referred to as I/O 0 (slow); I/O 1 (fast); I/O 2 (fast). Fast and slow refer to the speed at which the microprocessor accesses the I/O when in the address dependent mode (POKE65495,0). This is a very important point to remember since cassette input/output comes under control of I/O 1 (fast); so if the 6809 is running in the fast mode then the cassette I/O will not function properly.

Four locations

Each I/O is managed by a Peripheral Interface Adapter (PIA), though in the Dragon there is no PIA 2 because I/O 2 is reserved for future enhancement. Each PIA takes up four memory locations:

PIA 0: FF00-FF03 repeated seven times to FF1F

PIA 1: FF20-FF23 repeated seven times to FF3F

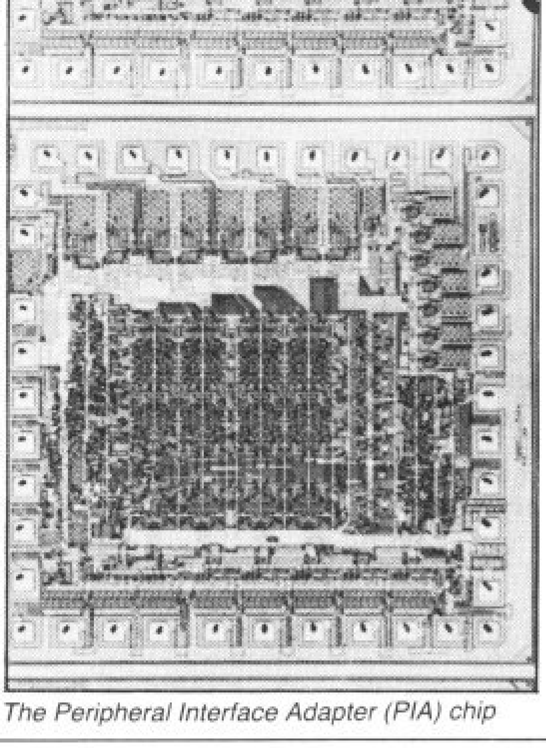
But what is even more remarkable is that each PIA has six registers, four of which are assigned to two memory locations.

The PIA is really a double PIO, parallel input output chip. And it has two ports A and B. Each port has three registers: a data direction register, a peripheral data register and a control register. These are allocated to the memory locations as shown in *Figure 1*.

Each register should be considered as 8 bits, each bit uniquely important. The contents of each register are examined by peeking to the relevant memory locations and converting the contents to an 8-bit binary number; this then represents the contents of each bit of the register, bits 0 through 7 reading from right to left. In the data direction register each bit 0 through 7 corresponds to data lines PA0 through PA7 (or PB0 through PB7). A '1' in a bit of this register means that that data line is programmed as an output. A '0' means that it is programmed as an input.

For an example, if the data direction register had been selected and you peeked at FF20, you would get FE returned (254). This is represented by 11111110 in binary, which means that since bit 0 is '0' then data line PA0 is an input. Bits 1 through 7 are '1', so data lines PA1 through PA7 are outputs.

As already mentioned, the peripheral data register and data direction register share a common memory address, but obviously the computer can only access the contents of one register — which register depends on the state of bit 2 of the control register. A '1' selects the peripheral data register. A '0' selects the data direction register. Peeking at the four control registers at FF01, FF03, FF21, FF23 returns B4, 35, 34, 37, respectively. This shows that the peripheral data registers have been selected in all four cases. This would seem sensible, since the computer has no use for the data direction register once it has programmed the various bits as input or output. The contents of the PDR on the other hand may be continuously changing.



The Peripheral Interface Adapter (PIA) chip

Now more about that control register. This controls the functions that are either on or off — such as audio and cassette motor.

Don't be alarmed by interrupt (*Figure 2*), it is not as complicated as people think. Basically an interrupt is a special subroutine, such as the triggering of a cassette relay, which the computer executes when it receives an interrupt request. When it is told to return from interrupt, it takes up from where it left off. An interrupt flag set to '1' indicates that an interrupt is requested. Interrupts can be disabled, though, so that a request is ignored.

Since there are two control registers in a PIA (A and B), there will be four control lines. They are CA1, CA2, CB1, CB2. Now I shall take a closer look at what each PIA does, starting with PIA0.

Firing

If one selects the DDR-A at FF00 and then peeks, 0 is returned, indicating that all eight bits are set to input, as expected. Bits 0 through 1 indicate whether the joysticks are being fired (*Figure 3*) A '0' in bit 0 indicates that the right joystick is being fired. A '0' in bit 1 indicates that the left joystick is being fired. A '0' in both bits indicates that both joysticks are being fired. A '0' in bits 0 through 6 indicates the row of keys (as connected on the circuit board) containing the key being pressed. Bit 7 is the joystick comparator, normally '1' this only appears to be '0' when JOYSTK(0)<32.

	PIA 0	PIA 1	
A	FF00	FF20	Peripheral data register (PDR-A)
	FF01	FF21	Data direction register (DDR-A) Control register (CR-A)
B	FF02	FF22	Peripheral data register (PDR-B)
	FF03	FF23	Data direction register (DDR-B) Control register (CR-B)

Figure 1: registers are allocated to two ports

7	6	5	4	3	2	1	0
INTERRUPT FLAGS		CONTROL LINE 2			DDR/PDR	CONTROL LINE 1	
← READ ONLY →		← READ/WRITE →					

Figure 2: interrupt is not as complicated as people think

	7	6	5	4	3	2	1	0
NORMAL CONTENTS	1	1	1	1	1	1	1	1
FF00 PDR-A	JOYSTICK COMP-ARATOR	← KEYBOARD ROW INPUT →					JOYSTICK FIRE	

Figure 3: indicate whether the joysticks are being fired

	7	6	5	4	3	2	1	0
NORMAL CONTENTS	1	0	1	1	0	1	0	0
FF01 CR-A	RO INTERRUPT FLAGS		CA2 MUX			DDR/PDR	CA1 UNUSED	

Figure 4: it would appear that the Dragon does not use CA-1

	7	6	5	4	3	2	1	0
NORMAL CONTENTS	0	0	0	0	0	0	0	0
FF02 PDR-B	KEYBOARD COLUMN INPUT							

Figure 5: deciding which key you are pressing

	7	6	5	4	3	2	1	0
NORMAL CONTENTS	0	0	1	1	0	1	0	1
FF03 CR-B	RO INTERRUPT FLAGS		CB-2 MUX			DDR/PDR	CB-1 IRQ ENABLE	

Figure 6: control line CB-1 is the IRQ-B enable

	7	6	5	4	3	2	1	0
NORMAL CONTENTS	0	0	0	0	0	0	0	0
FF20 PDR-A	DIGITAL TO ANALOGUE CONVERTER						PRINTER STROBE	CASS-ETTE INPUT

Figure 7: feeding numbers into the D-A converter

	7	6	5	4	3	2	1	0
NORMAL CONTENTS	0	0	1	1	0	1	0	0
FF21 CR-A	INTERRUPT FLAGS		CASSETTE RELAY			DDR PDR	PRINTER RELAY	

Figure 8: deals with the printer and cassette relays

	7	6	5	4	3	2	1	0
NORMAL CONTENTS	0	0	0	0	0	1	0	1
FF22 PDR-B	A/G	GM2	GM1	GM0	CSS	RAM SIZE	SINGLE BIT SOUND	PRINTER BUSY

Figure 9: including video control lines

	7	6	5	4	3	2	1	0
NORMAL CONTENTS	0	0	1	1	0	1	1	1
FF23 CR-B	INTERRUPT FLAGS		CB-2		SOUND ENABLE	DDR/PDR	CB-1 CARTRIDGE FIRQ	

Figure 10: indicating whether a cartridge is present

It would appear that the Dragon does not use CA-1 (*Figure 4*). CA-2 is the MUX LSB select and is connected with the X and Y inputs from the joysticks. When the sound is enabled, a '1' appears in bit 3, but this bit does not exclusively control the sound.

Printing

Checking the DDR-B confirms that all bits are input although they may be set as output when the printer is being used. By now the reader will have realised that if FF00 returns the row of a key being pressed and FF02 returns the column, then a unique key is defined; this is how the computer decides which key you are pressing (*Figure 5*).

If you press a key then a '0' appears in the two bits which correspond to that row and column. Unfortunately the computer clears FF02 immediately it has noted the contents, so peeking always returns the value 0. FF00, on the other hand, remains uncleared. If you enter the following short program, run it and play around on the keyboard it illustrates the point quite well:

```
10 PRINT HEX$ (PEEK (65280): GOTO 10
```

Back to the PIA: control line CB-1 is the IRQ-B enable (*Figure 6*). Putting a '0' in bit 0 disables it. If you do this then the functions which rely on this interrupt will also be disabled, namely the timer and the PLAY. The PLAY will play the first note of the string indefinitely; the TIMER will freeze altogether. So POKE &HFF03,&H34 will allow you to get those previously unobtainable high scores in races against time.

Data direction

In the PIA1 the data direction register sets bit 0 as an input as this is the single bit cassette data input. Bits 2 through 7 are set as outputs since these bits are linked to the digital to analogue converter for sound output. Once sound output has been enabled, sound is produced by feeding numbers into the D-A converter (*Figure 7*).

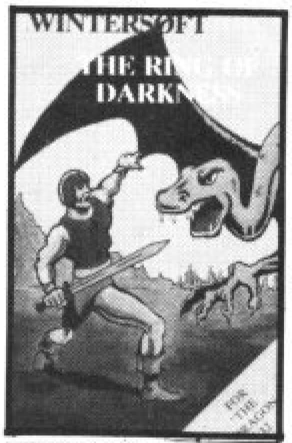
The control register (*Figure 8*) deals with the printer and cassette relays; in both cases the relay is triggered by means of an interrupt. For example setting bit 5 to '0' calls the cassette relay interrupt. Bit 3 is the line to the cassette remote — a '1' switches it on. This is used by the MOTORON, MOTOROFF commands.

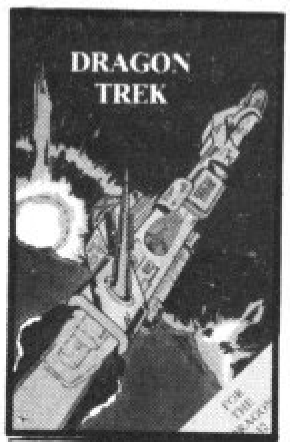
Bits 3 through 7 (*Figure 9*) are the video control lines. Bit 2 is the RAM size and is '1' by default. Bit 1 is the single bit sound output used in conjunction with the D-A converter at FF20 to produce sound. These lines are all set to input.

Bits 0,1 (*Figure 10*) indicate whether a cartridge is present; if it is, then control is transferred immediately. For the technically minded, once the computer is switched on and the computer has configured the PIA then the FIRQ flag goes up and a FIRQ calls the cartridge. Bit 3 is the sound enable bit used by SOUND, PLAY, AUDIO ON/OFF. Sound is output to the TV when this bit is set to '1'. Bits 4,5 must also be '1'. (Much of the notation used in this article is standard notation used by Motorola and is that company's copyright.) ■

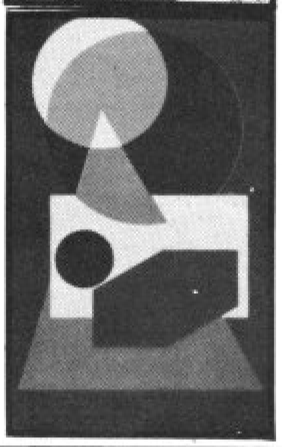
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Lines

From W J Greenall in Bishop's Stortford

THESE TWO PROGRAMS use the line facility of the Dragon 32 in producing curves from a series of straight lines, in much the same way as artists using string or copper wire and nails on a wooden base.

In each of the programs line 10 sets up the graphics mode and clears the high resolution screen, the FOR ... NEXT loops produce the series of lines required for the given pattern and the final program line holds the display static until the BREAK key is depressed. Without this the display returns automatically to the TEXT mode. In the second example line 60 paints out the unused portions of the screen.

Finally, after you have run one of the programs, press BREAK and type in NEW and press ENTER. Now enter the following one line program:

10 PMODE 4,1:SCREEN 1,0:GOTO 10

Run this. Then try altering the PMODE and SCREEN instructions in this program.

```
1 REM LINES BY W.J. GREENALL.
10 PMODE 4,1:SCREEN 1,Ø:PCLS
20 FOR X=Ø TO 191 STEP 8
30 LINE(X+64,Ø)-(255,X),PSET
40 LINE(X+64,191)-(255,191-X),PSET
50 NEXT
60 FOR X=191 TO Ø STEP -8
70 LINE(Ø,191-X)-(X,Ø),PSET
80 LINE(Ø,X)-(X,191),PSET
90 NEXT
100 GOTO 1ØØ
```

```
1 REM LINES 2 BY W.J. GREENALL
10 PMODE 4,1: SCREEN 1,Ø:PCLS
20 FOR X=192 TO Ø STEP -8
30 LINE (32,X)-(X+32,191),PSET
40 LINE (223,X)-(X+32,Ø),PSET
50 NEXT
60 PAINT(1,1):PAINT(225,1)
70 GOTO 7Ø
```

Scoring

From C Stone in Oldham

THIS PROGRAM CAN be used by any Dragon user to place a score routine on the hi-res screen. When adding this routine to a program enter the listing from lines 10 to 260. Lines 300 and 380 should not be entered as they are only used to test the program. Lines 300 to 310 are the works of the program, and are entered anywhere a program needs a score, and a score update.

Variables

N$=Data for drawing numbers.
B$=Data for blanking numbers.
S$=Data for drawing score.
A=Units counter.
A1=Tens counter.
A2=Hundreds counter

Lines 300-380 test the program

```
10 REM************************
20 REM**(C) C.A.STONE.1983**
30 REM************************
40 CLEAR500
50 DIMN$(11)
60 REM********************
70 REM DEFINE DRAW DATA
80 REM********************
90 N$(0)="C1BM+0,-1FR2EU4HL2GD4"
100 N$(1)="C1BM+1,+0U6G"
110 N$(2)="C1BM+4,+0L4UER2EU2HL2G"
120 N$(3)="C1BM+0,-1FR2EUHL2R2EUHL2G"
130 N$(4)="C1BM+3,0U6G3R4"
140 N$(5)="C1BM+0,-1FR2EU2HL3U2R4"
150 N$(6)="C1BM+0,-2ER2FDGL2HU4ER2F"
160 N$(7)="C1BM+2,+0U2E2U2L4"
170 N$(8)="C1BM+1,+0R2EUHL2HUER2FDGL2GDF"
180 N$(9)="C1BM+0,-1FR2EU4HL2GDFR3"
190 REM*******************
200 REM B$="BLANK NUMBER"
210 REM*******************
220 B$="C0BM+0,-6R20D1L20D1R20D1L20D1R20D1L20D1R20"
230 REM************
```

Continued on page 42

```
240 REM S$="SCORE"
250 REM*************
260 S$="C1BM+0,-1FR2EH4ER2FBM+4,+5HU4ER2FHL2GD4FR2EBM+4,+1R2EU4HL2GD4FBM+6,+0U6R
3FDGL3RF3BM+4,+0R4L4U3R4L4U3R4BM+4,+4R4BM+0,-2L4"
270 REM***************
280 REM DRAW NUMBERS
290 REM***************
300 PMODE4,1:SCREEN1,1:PCLS
310 A=A+1
320 IFA>9THEN A1=A1+1:A=0
330 IFA1>9THENA2=A2+1:A1=0
340 IFA2>9THEN A2=0:A1=0:A=0
350 DRAW"BM225,10"+N$(A2)+"BM232,10"+N$(A1)+"BM239,10"+N$(A)
360 DRAW"BM180,10"+S$
370 DRAW"BM225,10"+B$
380 GOTO310
```

Space Race

From Alison Dowey in Lurgan

THIS IS AN Invaders-type game in which you have to shoot all the aliens before your fuel runs out. The more aliens you shoot, the faster your fuel is used up. The instructions are contained in lines 670-720. Lines 10-150 set up the variables, 160-270 draw the screen, 280-590 are the main movement routine and 600-660 are the end-of-game routine.

```
10 '**SPACE RACE...BY...A.DOWEY
20 CLS:PRINT"DO YOU WANT INSTRUCTIONS(Y/N)"
30 A$=INKEY$:IFA$<>"Y" AND A$<>"N" THEN 30
40 IFA$="Y" THEN GOSUB680
50 POKE65495,0
60 K=0
70 DD=0
80 CLS0
90 '
100 TI=0:TK=0:TL=0:TJ=0
110 A=1024
120 HITS=1
130 B=A
140 SCORE=20
150 G=A+463
160 FORX=3 TO 27 STEP4
170 A=1024
180 FORI=0 TO288 STEP 32
190 POKEA+I,202
200 NEXTI
210 FORI=320 TO 456 STEP 32
220 POKEA+I,186
230 NEXTI
240 FORY=64 TO 320 STEP 64
250 POKEA+X+Y,145
260 POKEA+X+Y+1,153:POKEA+X+Y+2,153
270 NEXTY:NEXTX
280 '*****MOVEMENT*****
290 TI=TI+1
300 B$=INKEY$
310 IFB$="Z" THEN B1=-1
320 IFB$="X" THEN B1=1
330 IF K=1 THEN POKE SHOT,128
340 IFK=1 THEN SHOT=SHOT-32
350 IF SHOT<A THEN K=0
360 IF K=0 THEN 390
370 IF PEEK(SHOT-32)=153 THEN POKESHOT-32,128:POKESHOT-33,128:POKE SHOT-34,128:P
OKE SHOT-31,128:K=0:PLAY"T25503A":SCORE=SCORE+28
380 IF PEEK(SHOT-32)=145 THEN POKE SHOT-32,128:POKE SHOT-31,128:POKE SHOT-30,128
:PLAY"T25503A":K=0:SCORE=SCORE+28
390 '
400 PRINT@481,"SCORE";SCORE;" ";:SCREEN0,1
410 SCREEN0,1
420 IF SCORE=1000 THEN 570
430 IFK=1 THEN POKE SHOT,209
440 IFB$="M" AND K=0  THEN SHOT=G-32:K=1
450 G=G+B1
460 IFG>A+510-32 THEN G=A+510-32
470 IF G<A+449 THEN G=A+449
```

```
480 IF B1=1 THEN POKEG-B1,128
490 IFB1=-1 THEN POKEG+2,128
500 POKEG,231:POKEG+1,226
510 TJ=TI/(30-3*DD):TK=FIX(TJ)
520 IFTK=TL THEN 550
530 TL=TK
540 POKEA-32+32*TK,128
550 IF TL=15 THEN 600
560 GOTO280
570 DD=DD+1
580 POKEG,128:POKEG+1,128
590 GOTO90
600 CLS8:PRINT@226,"PLANET DESTROYED.HARD LUCK";:SCREEN0,1
610 PRINT@34,"TOTAL SCORE ";DD*1000+SCORE;
620 HO=DD*1000+SC:IFHO>HI THEN HI=HO
630 PRINT@98,"HI-SCORE IS ";HI;
640 PRINT@484,"PRESS KEY P";
650 SCREEN0,1
660 IF INKEY$="P" THEN GOTO 50 ELSE 660
670 CLS1
680 PRINT@34,"THIS IS AN INVADERS TYPE GAME   IN WHICH YOU HAVE TO SHOOT       AL
L THE ALIENS BEFORE YOUR       FUEL RUNS OUT.                          THE MORE ALIENS YO
U SHOOT          THE FASTER YOUR FUEL IS USED     UP."
690 PRINT:PRINT"THE KEYS ARE <-z x-> AND m FIRES"
700 PRINT@482,"PRESS A KEY TO PLAY"
710 IF INKEY$="" THEN710
720 RETURN
```

Brick Out

From Paul Hill in Stevenage

USE YOUR SKILL to break down the wall. Please note that POKE 65495,1 has been used to speed up the ball. If your machine will not run then delete line 900. Also do not break the game until the computer asks "Another game yes or no", as the poke will stop the cassette recorder working. The listing was printed using a Colour Graphic Plotter 115.

Program notes

Lines	
60-130	Set up.
140-240	Ask if joysticks or arrow keys are required.
250-320	Instructions of game.
330	Play a tune.
340-680	Brick wall and score routine.
690-780	Start of main loop and placing of the bat.
790-920	Ball position X and Y.
930-990	Convert X and Y to PRINT@.
1000-1090	Remove brick and play routine.
1100-1130	Random bounce.
1140-1160	Check if all bricks are removed and update on score.
1170-1230	New game tune.
1240-1370	Game over, display score and hi-score.

```
10 '        BRICK OUT
20 '
30 '       * BY P.HILL *
40 '          17-4-83
50 '      USING A CGP-115
60 ' --------------------------
70 '           SET UP..
80 HI=0:F=0:CLS7
90 FOR J=0 TO 31
100 B$=CHR$(128)
110 C$=C$+B$
120 NEXT J
130 D$=CHR$(195)+CHR$(195)+CHR$(195)
140 '--------------------------
150 PRINT@42,"BRICK OUT!";
160 FOR N=74 TO 83
170 PRINT@N,"=";:SOUND 50,2
180 NEXT N
190 PRINT@134,"WHICH WILL YOU USE -";
200 PRINT@194,"JOYSTICK(1) OR ARROW KEYS
(2)";
210 PRINT@262,"ENTER ";:INPUT JA
220 IF JA>2 THEN 150
230 IF JA=1 THEN F=1
240 IF JA=2 THEN F=2
250 CLS7
260 PRINT@66,"USE YOUR SKILL TO REMOVE A
LL";
270 PRINT@130,"THE BRICKS.";
280 PRINT@194,"FOR EACH BRICK HIT YOUR S
CORE";
290 PRINT@258,"WILL BE INCREASED BY ";
300 PRINT@322,"10 POINTS.";
310 PRINT@450,"PRESS A KEY TO START..";
320 A$=INKEY$:IF A$=""THEN 320
330 GOSUB 1220
340 CLS0:G=1:S=0:S1=0
350 PRINT@2,"score";+CHR$(128);S1;
360 PRINT@17,"hi";+CHR$(128);"score";HI;
370 '--------------------------
380 GOSUB 390:GOTO 690
390 ' BRICKS & WALL SUBROUTINE
400 FOR N=32 TO 62 STEP 2
410 PRINT@N,CHR$(159);
420 NEXT N
430 FOR N=33 TO 63 STEP 2
440 PRINT@N,CHR$(255);
450 NEXT N
460 FOR N=64 TO 94 STEP 2
470 PRINT@N,CHR$(255);
480 NEXT N
490 FOR N=65 TO 95 STEP 2
500 PRINT@N,CHR$(159);
510 NEXT N
```

Continued on page 44

```
520 FOR N=96 TO 126 STEP 2
530 PRINT@N,CHR$(159);
540 NEXT N
550 FOR N=97 TO 127 STEP 2
560 PRINT@N,CHR$(255);
570 NEXT N
580 FOR N=128 TO 158 STEP 2
590 PRINT@N,CHR$(255);
600 NEXT N
610 FOR N=129 TO 159 STEP 2
620 PRINT@N,CHR$(159);
630 NEXT N
640 FOR N=0 TO 448 STEP 32
650 PRINT@N,CHR$(133);
660 PRINT@N+31,CHR$(138);
670 NEXT N
680 RETURN
690 '--------------------------
700 X3=1:Y3=1:X=RND(27)+3:Y=RND(5)+15
710 ' LOOP..
720 ' KEY OR JOYSTICK MOVEMENT..
730 IF F=1 THEN XX=(JOYSTK(0)*.42):GOTO
760
740 IF F=2 AND PEEK(343)=223 THEN XX=XX-
1:IF XX<0 THEN XX=0
750 IF F=2 AND PEEK(344)=223 THEN XX=XX+
1:IF XX>27 THEN XX=27
760 PRINT@449+XX,D$;
770 PRINT MID$(C$,XX+3,27-XX);
780 PRINT@449,LEFT$(C$,XX);
790 '--------------------------
800 ' BALL POSITION X & Y
810 X=X+X3:Y=Y+Y3
820 IF X<3 THEN X3=1
830 IF X>60 THEN X3=-1
840 IF Y<3 THEN Y3=1
850 IF Y>29 THEN G=G+1:PLAY"L4001GFEDC":
IF G>3 THEN 1260 ELSE 700
860 SET(X,Y,0)
870 IF POINT(X,Y)=2 THEN S1=S1+10:GOSUB
950
880 IF POINT(X,Y)=8 THEN S1=S1+10:GOSUB
950
890 IF POINT(X,Y)=5 THEN PLAY"L80C":Y3=-
1
900 POKE 65495,1:' SPEED UP!!
910 RESET(X,Y)
920 GOTO 710
930 '-------------------
940 ' CHANGE X,Y TO PRINT @
950 IF INT(Y/2)=Y/2 THEN NY=Y*16:GOTO 97
0
960 NY=(Y-1)*16
970 IF INT(X/2)=X/2 THEN NX=X/2:GOTO 990
980 NX=(X-1)/2
990 A=(NY+NX)
1000 '--------------------------
1010 POKE 65494,1:'SLOW DOWN!!
1020 ' REMOVE BRICK..
1030 FOR NN=1 TO 5
1040 PRINT@A,CHR$(159);
1050 FOR N=1TO5:NEXT N
1060 PRINT@A,CHR$(128);
1070 NEXT NN
1080 PLAY"L25505CDEFGO4FEDCBA"
1090 D=RND(3)
1100 ' RANDOM BOUNCE..
1110 IF D=3 THEN X3=1
1120 IF D=2 AND Y<>9 THEN Y3=-1:GOTO 114
0
1130 Y3=1:D=0
1140 S=S+1:IF S>119 THEN GOSUB 1310:S=0:
GOTO 1250
1150 PRINT@8,S1;
1160 RETURN
1170 '--------------------------
1180 ' NEW GAME TUNE..
1190 FOR N=1 TO 2
1200 PLAY"L4004ACEGO3ACEGO4ACEG"
1210 NEXT N
1220 PLAY"L4004CDEFGABO5CDEFG"
1230 RETURN
1240 '--------------------------
1250 ' >>- GAME OVER -<<
1260 IF S1>HI THEN HI=S1
1270 POKE 65494,1:'SLOW DOWN!!
1280 CLS6:PRINT@42,"GAME OVER.";
1290 PRINT@74,"==========";
1300 PRINT@169,"YOUR SCORE:-";S1;
1310 PRINT@265,"HI SCORE:-";HI;
1320 FOR DE=1 TO 400:NEXT DE
1330 PRINT@452,"ANOTHER GAME YES OR NO";
1340 G$=INKEY$
1350 IF G$="Y"THEN 330
1360 IF G$="N"THEN CLS:END
1370 GOTO 1340
```

Loading hex

From Peter Barry in Wirral

THIS IS A simple method of loading hexadecimal numbers directly into memory. The program listed is a short machine code routine for 'un-NEWing' an accidentally 'NEWed' program. If this should happen then a simple EXEC 32754 will bring the program back. The routine will not work if you type in a new Basic line or define a new variable before restoring the *old* program.

```
10 CLEAR 200,32753
20 DATA 9E,19,BD,83,F3
30 DATA 30,02,9F,1B,9F,1D,9F,1F,39
40 FOR I=0TO13
50 READ A$:A$="&H"+A$
60 POKE 32754+I,VAL(A$)
70 NEXT I
```

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DRAGON USERS. Send your program on tape which I will return with printed listing, £2.00. M. Swanson, 5 High Street, Spilsby, Lincs.

BY RETURN LISTING SERVICE for Dragon BBC Spectrum Newbrain Oric. Send £1 per program plus tape, plus sae to Byte 7, Riverway, Nailsea, Avon (0272) 851337.

Here's my classified ad.

(Please write your copy in capital letters on the lines below.)

£0.20	£0.40	£0.60	£0.80
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I make this................................ words, at 20p per word so I owe you £.................................

Name..

Address..

....

....

Telephone..

Please cut out and send this form to: Classified Department, *Dragon User*, Hobhouse Court, 19 Whitcomb Street, London WC2

Labelling

From P Williams in Guisborough

THIS PROGRAM UTILISES the good text handling abilities of the Dragon. The idea of the program is to produce, on a printer, leaflets or labels which could be used for advertising, book or record labels, invitations, admission tickets, or any similar use by small clubs or private individuals. The unique aspect of the program is that each line of text is automatically centred on the line. This produces a professional appearance.

Program notes

Lines	
20	Clears enough space for an A4 size printout.
50-100	Specifies size and border style.
120-150	Input of each line of text. Note the use of line input in 140 to accept any input.
160-220	The printout to the screen. The centralising is done by lines 190 and 200 by deducting the LENgth of the line string from the width(W) and dividing by two. The INT function is used in order to cater for odd-width lines.
310-500	The printout, using similar procedures as above.
630-end	This is a facility for modifying various aspects of the format

```
10 REM++++++LEAFLET++++++++++++
15 REM (C)P.WILLIAMS 1983
20 CLEAR5280
30 CLS:PRINTTAB(9)"LEAFLET PRINTER":PRINTSTRING$(32,"*")
40 PRINT
50 INPUT"WHAT WIDTH":W
60 INPUT"WHAT HEIGHT":H
70 INPUT"WHAT SYMBOL FOR BORDER":B$
80 CLS:PRINT"WE CAN NOW ADD EACH LINE OF TEXT"
90 PRINT"IF YOU REQUIRE A BLANK LINE"
100 PRINT"ENTER 0(ZERO)"
110 DIML$(W)
120 FORX=2TO(H-1)
130 PRINT"LINE(";X;")?"
140 LINEINPUT L$(X)
150 NEXT X
160 PRINTSTRING$(W,B$)
170 FORX=2TO(H-1):PRINTB$;
180 IFL$(X)="0"THEN240
190 FORZ=1TOINT(((W-2)-LEN(L$(X)))/2):PRINT" ";:NEXTZ
200 PRINTL$(X);:FORV=(Z+LEN(L$(X)))TO(W-3):PRINT" ";:NEXTV
210 IF(V+Z+LEN(L$(X)))=W-2THEN220ELSEPRINT" ";
220 PRINTB$
230 GOTO250
240 FORZ=2TO(W-1):PRINT" ";:NEXT Z:PRINTB$
250 NEXTX
260 PRINTSTRING$(W,B$)
270 INPUT"IS THIS OK";A$
280 IFA$="N"THENGOTO610
290 IFA$="Y"THEN310
300 GOTO270
310 CLS:PRINT@(32*6)+8,"IS PRINTER READY?":INPUTR$
320 IF R$="Y"THEN340
330 GOTO310
340 INPUT"HOW MANY PRINTS DO YOU REQUIRE":N
350 FORP=1TON
360 CLS:PRINT@(32*8),"LEAFLET NO. ";P;" BEING PRINTED"
370 PRINT:PRINT(N-P);" MORE TO PRINT"
380 FORY=1TO(W-1):PRINT#-2,B$;:NEXTY:PRINT#-2,B$
390 FORX=2TO(H-1):PRINT#-2,B$;
400 IFL$(X)="0"THEN460
410 FORZ=1TOINT(((W-2)-LEN(L$(X)))/2):PRINT#-2," ";:NEXTZ
420 PRINT#-2,L$(X);:FORV=(Z+LEN(L$(X)))TO(W-3):PRINT#-2," ";:NEXTV
430 IF(V+Z+LEN(L$(X)))=W-2THEN440ELSEPRINT#-2," ";
440 PRINT#-2,B$
450 GOTO470
460 FORZ=2TO(W-1):PRINT#-2," ";:NEXTZ:PRINT#-2,B$
470 NEXTX
480 FORY=1TO(W-1):PRINT#-2,B$;:NEXTY:PRINT#-2,B$
490 PRINT#-2
500 NEXT P
510 CLS:PRINT@(32+6)+8,"LEAFLET FINISHED"
520 INPUT"IS THIS OK":S$
530 IFS$="Y"THENCLS:GOTO560
540 IFS$="N"THEN610
550 GOTO520
560 PRINTTAB(10)"ANOTHER ONE ?":INPUTS$
570 IFS$="Y"THEN310
580 IFS$="N"THENCLS:GOTO600
590 GOTO560
600 CLS:PRINT@(32*8)+4,"THANK YOU.HAVE A NICE DAY":END
610 CLS:PRINTTAB(7)"LEAFLET AMMENDMENT"
620 PRINTSTRING$(32,"-")
630 PRINT:PRINT"OPTIONS FOR ALTERATION:-"
640 PRINT:PRINT"  1.START AGAIN"
650 PRINT"  2.CHANGE A LINE"
660 PRINT"  3.CHANGE BORDER SYMBOL"
670 PRINT:INPUT"SELECT 1,2 OR 3":S
680 IF S=1GOTO10
690 IF S=2 GOTO720
700 IF S=3 GOTO 800
710 GOTO670
720 CLS:INPUT"WHICH LINE NUMBER DO YOU WISH TO CHANGE":C
730 PRINT:PRINT"LINE ";C;" IS AS FOLLOWS:-"
740 PRINT:PRINT L$(C)
750 PRINT:PRINT"WHAT DO YOU WISH THE LINE TO BE":LINEINPUTL$(C)
760 PRINT:INPUT"DO YOU WISH TO CHANGE ANYTHING ELSE":A$
770 IFA$="Y"THEN610
780 IFA$="N"THEN310
790 GOTO760
800 CLS:PRINT"EXISTING SYMBOL IS:-";B$
810 INPUT"WHAT SYMBOL DO YOU REQUIRE":B$
820 GOTO760
```

Reaction

From Nicholas Appleyard in Sheffield

THIS GAME IS intended to test reaction time. When the program is run, a dot is printed on the screen at a random time and at a random point on the screen. When the dot appears the player presses the space bar and the reaction time then appears on the screen.

The program notes are as follows:

20-60	Prints out the instructions.
70-74	Prints out the dot at a rnd time and at a rnd point.
80	Adds up the time if the space bar is not pressed.
90	Stops time.
95-230	Prints out the answers.

```
5 ' *  *  *  FOR THEDRAG ON 32 *
    *  *
10 ' *  * REACTI ON  *  *
11 ' *  * BYNICHOLASAPPLEYARD * A
    GED13 *  *
12 ' *  * 1983 *  *
20 CLS2
30  PRINT @64,"THIS IS TO TEST YO
    UR REACTIONS"
40  PRINT "PRESS THE SPACE BAR WH
    EN YOU SEE " CHR$ (128 + 48)

50  FOR A = 1 TO 5000: NEXT A
55 CLS4:TIME = 0
60 PLAY"CDEFGAB;B;B;B;B;AGFEDC"
70 CLS
71 Y =  RND (3000)
72 X =  RND (480)
73  FOR N = 0 TO Y: NEXT N
74  PRINT @X, CHR$ (128 + 48)
80 TIME = TIME + 1
90  IF INKEY$ = " " THEN 110
95  IF TIME > 70 THEN 200
100  GOTO 80
110  IF TIME = 1 THEN 170
115 CLS
120  PRINT @32,"YOUR TIME WAS ";T
     IME
130 PLAY"T6L3BL8AL3GL8FL3EL8DL1C"

140  PRINT "PRESS ANY KEY TO TRY
     AGAIN";
150  IF INKEY$ = "" THEN 150
160  GOTO 55
170 CLS: PRINT @32,"CHEAT!! DON'T
     KEEP YOUR FINGER ON THE BAR
    !"
180 SOUND1,50
190  GOTO 140
200 CLS: PRINT @32,"YOU HAVE GRAN
    NY REACTIONS!!"
210 PLAY"AB;AB;B;B;A"
220  GOTO 140
230  END
```

If you've got a technical question or problem write to Cathy Hyde, Dragon Answers, *Dragon User*, Hobhouse Court, 19 Whitcomb Street, London WC2 7HF

Dragon Answers

Bugs for no reason

IF I may be allowed to impinge on your space I have a couple of questions on the Dragon.

First, if the computer is awaiting an input and is left for 10 minutes or more, the program develops a bug and is consequently lost. This is most frustrating if the program is home-grown and no hard copy has been made.

Secondly, when entering a program or just running one bugs appear for no reason. Use of the RESET button does not help, the keyboard loses control and strange combinations of letters and figures appear on the screen. Any clues?

G Webber,
Weymouth,
Dorset.

THE TWO problems you have described are most probably tied in with each other. As mentioned in the answer to a similar query in the May issue of *Dragon User*, you should first check whether there are large fluctuations in the mains power supply coinciding with the crashes. If this is the case, a good filter may be required.

Also check whether the speed-up poke is used in any of the programs, as this will generally give a similar effect or cause the machine to lock up.

If, on checking both these points, neither can be seen to be causing the problem, you should return the machine to the original dealer for testing.

Other languages

I HAVE owned a Dragon computer for two months and am very pleased with it.

I have seen another language advertised to use with my machine. It is Forth and comes in tape form. Although not dissatisfied with the Basic used with the Dragon, I would like to know if there are any real advantages in using this new language.

Simon Webber,
Wellington,
Somerset.



THE MOST obvious advantage of Forth over your existing Basic is that it runs a lot faster. Once familiar with the language you should also find it easier to write programs and they should also be easier to debug.

Dragon Data will be marketing a version of Forth on cassette which will allow you to access Basic.

Keyboard grievances

AS THE owner of a Dragon 32 computer, which I have possessed for six months, I am pleased with its overall performance. Having said this, however, I have two small grievances: the size of the screen display and the lack of response from the 'cheap' keyboard.

Can the chips containing the screen display be replaced with those for another machine? And do you know of any manufacturer who produces a quality keyboard into which the 'guts' of the Dragon might be transplanted with a few alterations?

Duncan Rennie,
Cults,
Aberdeen.

I'M AFRAID I can't help you with either of your questions. The chips can't be replaced, but cartridges for 51 by 24 display are available. The Dragon's keyboard is one of the most expensive components in the Dragon and I don't know of anybody offering alternatives.

Memory details

I AM a fifth-form student at Billericay School, currently embarking on the Youth Enterprise Scheme, in which I plan to sell computer software.

I would be very grateful if you could advise me where I can find a detailed printout of the Dragon 32 memory map.

C Stichbury,
Billericay,
Essex.

WHILE THERE is a basic memory map provided in the additional information appendix to the Dragon manual, this is not comprehensive enough for many users such as yourself.

Dragon Data now has a booklet called information for machine code users which is available on request. This booklet gives a more detailed memory map and some useful locations for those interested in machine code. Also included in the booklet are details on monitor and joystick connections which have proved useful to many users.

Graphics with text

AS EVERYONE is aware, it is not supposed to be possible to print text on a high resolution screen on the Dragon, although I have of course read various methods of drawing characters including the excellent articles by David Lawrence.

However, the higher resolutions take up four 'pages' which are in horizontal bands across the screen. I wonder if it is possible to display only three pages, using the bottom quarter of the screen for captions in normal text. It sounds feasible but I can't work out how to do it.

F W Hart,
Moulton,
Northants.

UNFORTUNATELY IT is not possible to mix true text and true graphics due to the fact that the text graphic mode is controlled by bit 7 of $FF22. Therefore, as there is only one control bit, it selects either graphics (bit 7 set) or text (bit 7 clear).

Saving with hex

I HAVE been using the Tandy manuals *Getting started* and *Going ahead with Colour Basic*. On a Tandy it seems possible to CSAVEM using hex addresses as opposed to decimal. I could not make this work. Can you tell me if it can be done? This is the example:

CSAVEM'x',4E,6F,5F

If it can't be done, do you know why?

Pauline Hampson,
Lawton Heath,
Alsager.

IT IS certainly possible to use the CSAVEM command with hexadecimal addresses on the Dragon 32. All hexadecimal numbers should be preceded by an '&H' to indicate that the following alphanumeric is a hexadecimal number.

Therefore, the example you have noted should read:

CSAVEM'x',&H4E,&H6F,&H5F

where &H4E specifies the start address in memory, &H6F represents the end address and, finally, &H5F represents the execute address.

POINT problems

I HAVE had a Dragon 32 now for six months and during this time two major problems have been spoiling my attempts to write programs. I can't get either the POINT or PPOINT command to work.

M Treanor,
Benfleet,
Essex.

THE POINT and PPOINT commands may be tested with the following routines:

```
POINT   10 CLS 3
        20 PRINT POINT(20,20)
PPOINT  10 PMODE 3:SCREEN
        1,0
        20 PCLS 3
        30 PRINT
        PPOINT(20,20)
```

These routines should both give the value 3 as the answer.

If your Dragon does not give the correct answer you should return it to the original dealer for testing.

Answers to Competition Corner, *Dragon User*, Hobhouse Court, 19 Whitcomb Street, London WC2 7HF.

Put robot power on your Dragon

Gordon Lee tests your skill at solving alphametics – Powertran provides the prizes.

ONE OF THE oldest types of mathematical puzzle is the 'cryptarithm' in which letters are substituted for digits, and the solver has to discover the original values. Try this example:
ABCDE ⋆ 4 = EDCBA
The answer is 21978 ⋆ 4 = 87912

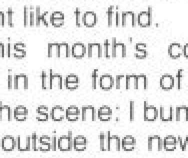
In 1955, J A H Hunter invented the first cryptarithms that actually formed logical sentences. We now hear that:
STARS + RATE = TREAT
FOUR + FIVE = EIGHT
(the alphametic is correct even if the sum isn't!) — or even
CELLAR + MURDER + CLERIC = CLEARED

The numeric equivalents of the above alphametics are:
89568 + 6591 = 96159
6057 + 6291 = 12348 and
102263 + 983703 + 120341 = 1206307
In fact the second of the three puzzles has several other alternative solutions that you might like to find.

This month's competition question is also in the form of an alphametic. Let me set the scene: I bumped into Alan the other day outside the newsagents. "Just been for my magazines," he announced, showing me a copy of *Dragon User*, and also one of those word puzzle books.

"You seem to be getting on fine with your new Dragon," I remarked. "But I didn't know that you were interested in word puzzles as well. Here's something for you to try that combines the two."

I sketched out the following alphametic based on the words DRAGON USER.



"What you have to do," I explained, "is to substitute digits for letters — each different letter standing for a different digit."

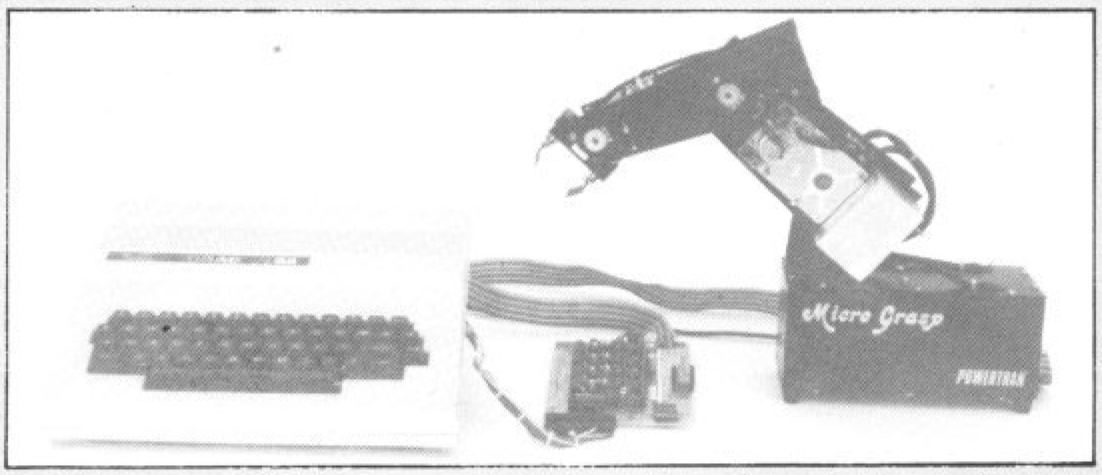
"I see," muttered Alan, scratching his head. "And also both 'DRAGON' and 'USER' are perfect squares," I called after him as he walked away.

Later that day the phone rang. It was Alan. "About this puzzle," he said, "I've been working on it and it seems that there are a number of possible alternatives."

"Well," I replied, "in the answer I had in mind, the word DRAGON represents my phone number, and you've just dialled it."

A few minutes later the phone rang again. "I still haven't enough information," announced Alan plaintively.

"Well let's say that the number represented by the letter 'E' is the same as my house number." As Alan knew my address he was able to solve the problem instantly. Can you?



Prize

THE PRIZE THIS month is a Micrograsp robot from Powertran Electronics, including all the necessary interfaces.

Rules

TO WIN THE robot, you have to send in the most elegant solution to the puzzle. You must show how the competition can be solved with the use of a Basic program, developed on your Dragon 32 computer.

As a tie-breaker, complete the following sentence in 15 words or less:

I want to add a robot to my Dragon in order to ....

....

Your entry must arrive at *Dragon User* by the last working day in July 1983. The name of the winner, and the solution to the puzzle, will be printed in the September issue of *Dragon User*. You may only enter the competition once. Entries will not be acknowledged and we cannot enter into correspondence on the result.

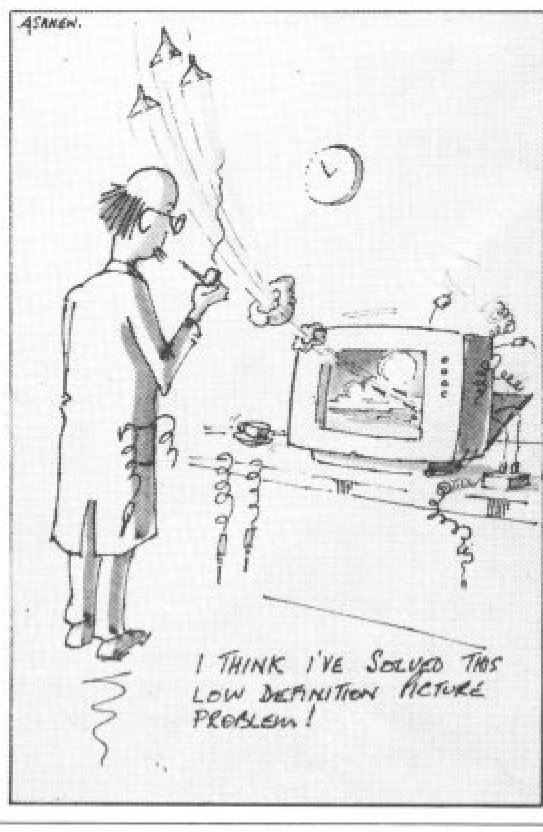
Please send your entries to Competition Corner, Dragon User, Hobhouse Court, 19 Whitcomb Street, London WC2 7HF.

May winner

In the May competition, the number of terms needed to exceed each successive integer is:
2(4); 3(11); 4(31); 5(83); 6(227); 7(616); 8(1674); 9(4550) and 10(12367).

Note that if the number of terms needed to exceed each integer is divided by the number of terms required to exceed the next smallest integer, the result — as the series progresses — converges on 2.718281828 — the constant *e*.

The winner is Gordon Harris of Middlesbrough who will be receiving his prize of a printer and word processing package from Microdeal.

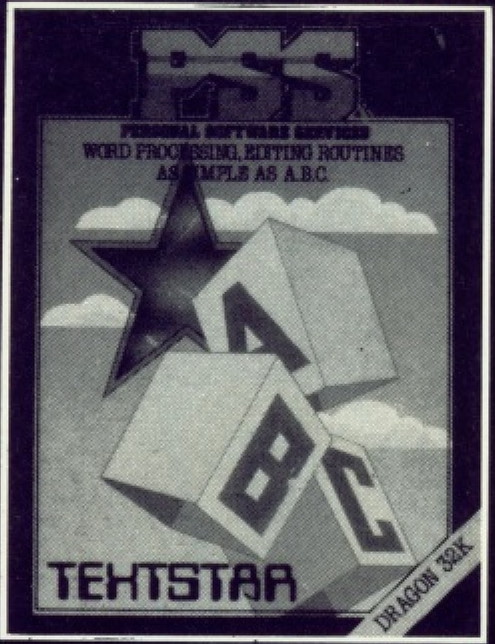


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TEXTSTAR 12·95

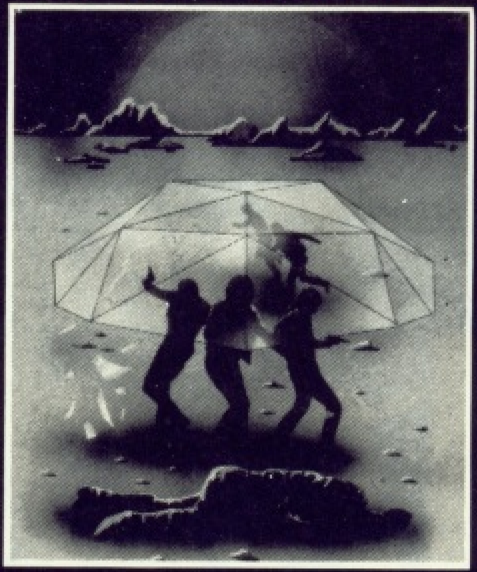
TEXTSTAR ENABLES THE USER TO CONSTRUCT FILES IN ASCII FORMAT WHICH MAY BE RECORDED ON CASSETTE TAPE AND SUBSEQUENTLY RELOADED FOR EDITING, EXAMINATION OR PRINTING.

TEXTSTAR MAY BE USED EITHER AS A WORD PROCESSOR INCLUDING ALL THE USUAL FUNCTIONS OR TO EDIT BASIC PROGRAMS.

TEXTSTAR WILL HANDLE UP TO 21000 BITS OR A 20K PROGRAM ON 32K MACHINES. THIS IS THE EQUIVALENT OF 6 PAGES OF A4 TEXT PER LOADING.

DRAGBUG 12·95

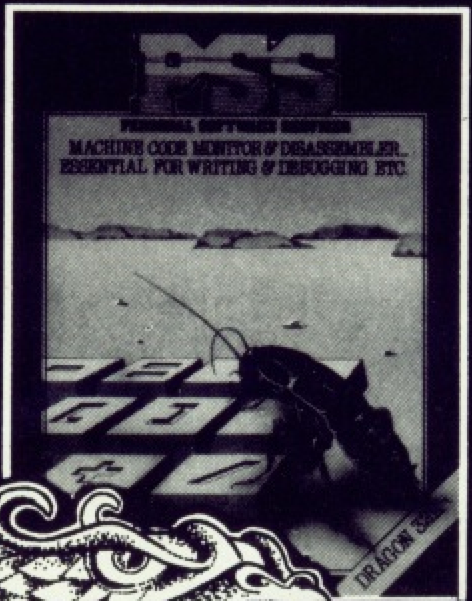
DRAGBUG IS ESSENTIALLY A MACHINE CODE MONITOR FOR THE DRAGON 32K GIVING THE USER EASY WRITING, ENTERING AND DEBUGGING FUNCTIONS FOR MACHINE CODE WRITING. IT INCLUDES ALL THE FEATURES OF PROFESSIONAL MONITORS FOUND ON LARGER MACHINES.

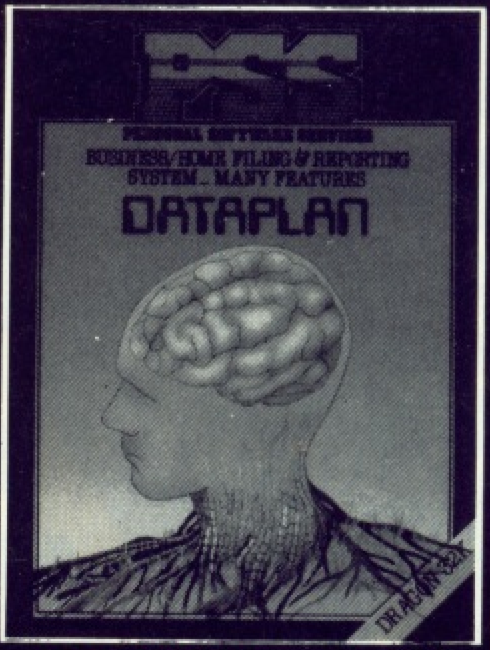


ATTACK 7·95

ATTACK IS A SUPER FAST, ALL MACHINE CODE ARCADE STYLE GAME FOR YOUR DRAGON 32K.

YOU ARE THE CHIEF SECURITY OFFICER ON THE PRISON PLANET 'KOVENTRI' WHERE ALL THE CAPTURED SPACE INVADERS ARE KEPT UNTIL A HUMANE WAY OF DEALING WITH THEM CAN BE FOUND. THERE HAS BEEN A MAJOR BREAKOUT AND IT IS A RACE AGAINST TIME TO STUN THE INVADERS AND CARRY THEM BACK TO THE SECURITY COMPOUND. AFTER BEING IN THE OPEN TOO LONG THEY MUTATE AND BECOME MUCH FIERCER. SEE HOW LONG YOU CAN KEEP THEM ALL LOCKED UP FOR.





DATAPLAN 12·95

DATAPLAN IS A DATABASE TYPE FILING SYSTEM WHICH ALLOWS THE USER TO ACCESS, SORT AND PRINT INFORMATION AS IT IS REQUIRED.

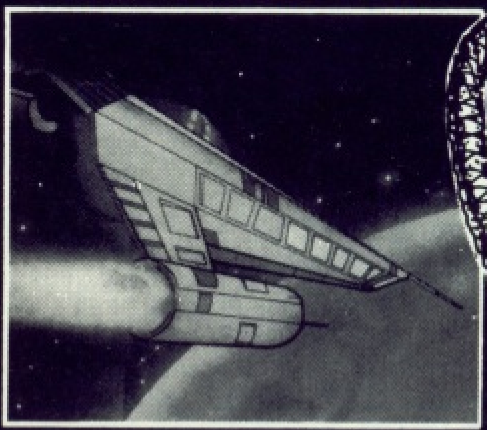
IT IS ENTIRELY MENU DRIVEN FLEXIBILITY IS ITS STRONG POINT

DATAPLAN WILL STORE UP TO 200 LINES OF INFORMATION EACH OF 64 CHARACTERS OR 100 RECORDS EACH OF 127 BITS.

STARTREK 7·95

THIS VERSION OF THE POPULAR GAME OF STAR TREK PUTS YOU IN COMMAND OF THE SS ENTERPRISE DURING THE WAR WITH THE EVIL KLINGONS. YOU ARE TOLD THAT THE EMPIRE HAS BEEN INVADED AND IT IS YOUR MISSION TO DESTROY THE ENEMY.

FEATURES INCLUDE: BATTLE COMPUTER, LONG/SHORT RANGE SENSORS, WARP DRIVE, IMPULSE ENGINES, PHASERS, PHOTON TORPEDOES ETC ETC.





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